Aug. 5, 1920 American Machinist Vol. 53, No. 6

Stamets Crankshaft Milling Machine

By Ethan Viall
Editor, *American Machinist*

Machines of this type are always suggestive of other applications for special purposes. Many large firms refuse to build such special machinery, as they prefer to stick to their standard line. The concern building this machine, however, has been very successful in the designing and building of machines to meet difficult problems of mass production which are becoming quite frequent.

OWING to its irregular form and springy nature, the multiple-throw crankshaft has always presented serious machining difficulties. Numerous special machines have been designed and built from time to time, in order to increase the output and reduce the cost of such work. A majority of these machines have been for work on the bearings and crankpins. Others are used to finish the sides or cheeks, but very few, if any, have been heretofore made to machine the outside or periphery, of the webs. In cases where such work has been required, grinding and polishing have usually been resorted to. On the late types of counterbalanced crankshafts however, grinding and polishing do not produce sufficiently accurate results, and where the webs are of the flat-sided, irregular outline type, some form of real machining is necessary to secure the proper balance. It is for an especially difficult job of such crankshaft work that the machine described in this article has been designed and built by William K. Stamets, Pittsburgh, Pa.

Fig. 1 shows a full front view of the machine and Fig. 2 a close-up of the cutters and work. A line drawing of the crankshaft upon which the machining is done is shown in Fig. 3, from which it will be seen that the machining of the peripheries of the various webs is practically a cam cutting job. Webs like *A* and *C* might possibly be machined with a turning tool, but to machine web *B* in that way would be impractical. In any case, milling cutters offer the best means of removing the surplus metal from the peripheries of the various webs in this particular instance.

It is inadvisable to attempt to machine all the webs at one setting, so two different machines are used, each machine milling the peripheries of four webs. The cutter lay-out for assembly "A" is shown in Fig. 4 On the machine with this cutter arrangement, the master

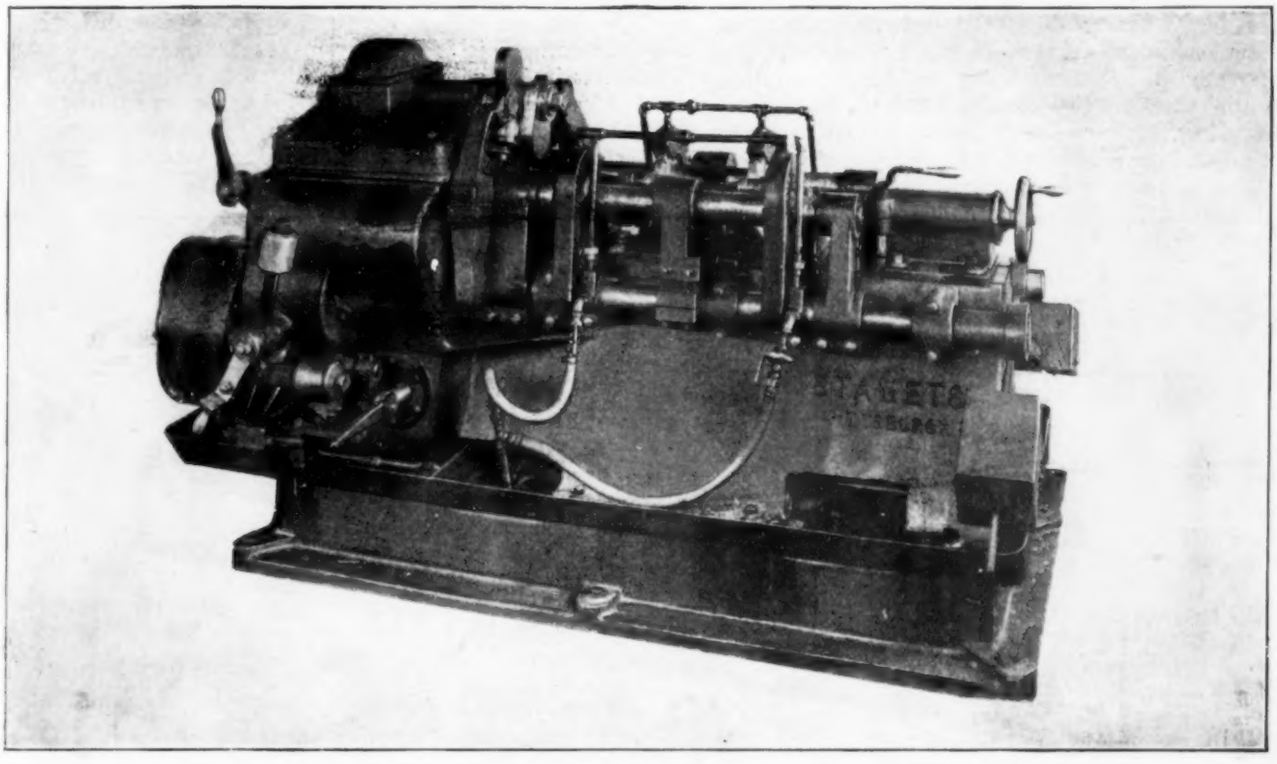


FIG. 1. STAMETS AUTOMATIC CRANKSHAFT MILLING MACHINE

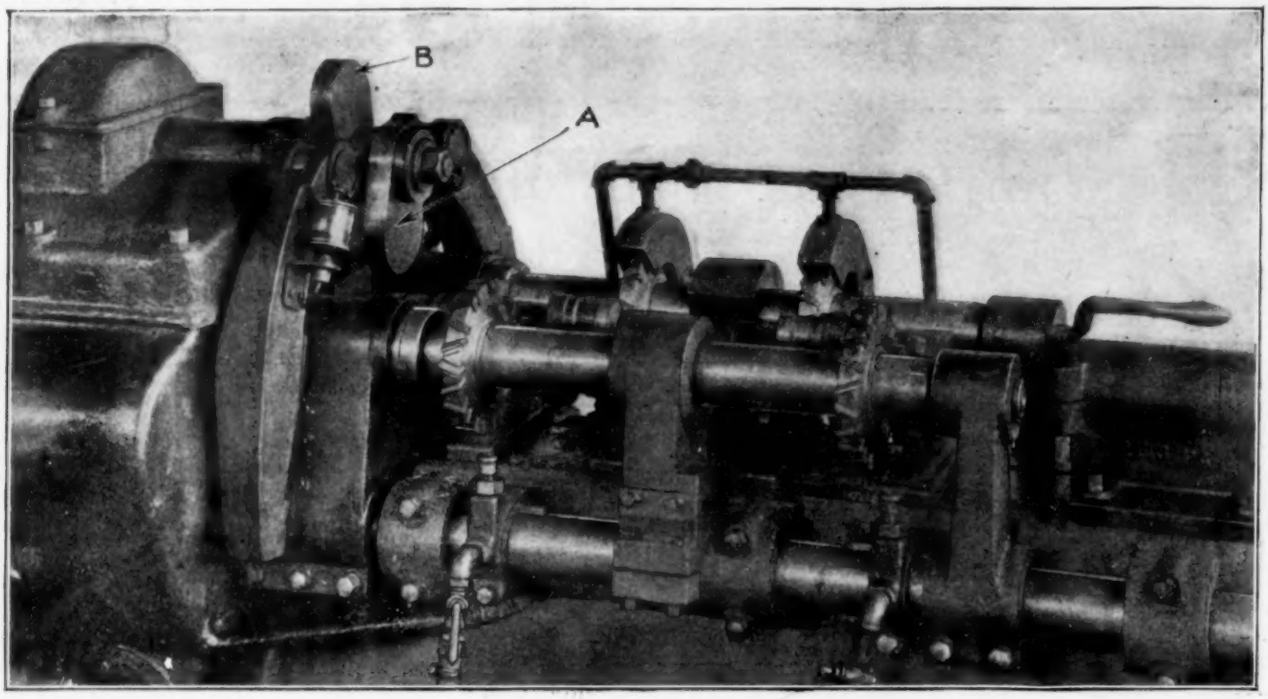


FIG. 2. CLOSE-UP OF THE WORK AND CUTTERS

forms are shaped as shown at *A* and *B*, Fig. 5. *A* top view of the machine with set-up *B*, is shown in **Fig. 6.**

Operation of the Machine

Keeping the illustrations referred to in mind, we will now go back to Fig. 2 and describe the operation of the machine in detail. After the driving disk and bearings of the crankshaft are machined it is ready to be placed in the milling machine. Here the turned bearings rest in journals and the driving disk is pinned to the spindle faceplate, the tail center supporting the outer end. The crankshaft must, of course, be located correctly in relation to the master cams, *A* and *B*. As there are six jig-drilled holes in the crankshaft driving disk, this locating is simply a matter of slipping the disk over pins in the spindle faceplate.

The milling-machine spindle and crankshaft turn so as to give a feed of about 4½ in. per min. The cutters which are 7 in. in diameter for the large webs and 9 in. in diameter for the smaller ones, run so as to give a surface speed of about 75 ft. per min. It will be seen from the illustration that the milling cutter teeth are set at a considerable angle to give a shearing cut in the tough steel of the crankshaft.

Means are provided for changing the spindle speed in order to compensate for the irregular shape being milled, so that the feed remains approximately 4½ in. per min. on the outside surface of the webs throughout the cut. This is done by means of an automatic gear shift in the spindle drive.

The milling cutters are carried on arbors supported by rocker arms as shown, three rocker arms being provided for each arbor. The rocker arm next to the head carries the arbor-driving spindle into which the

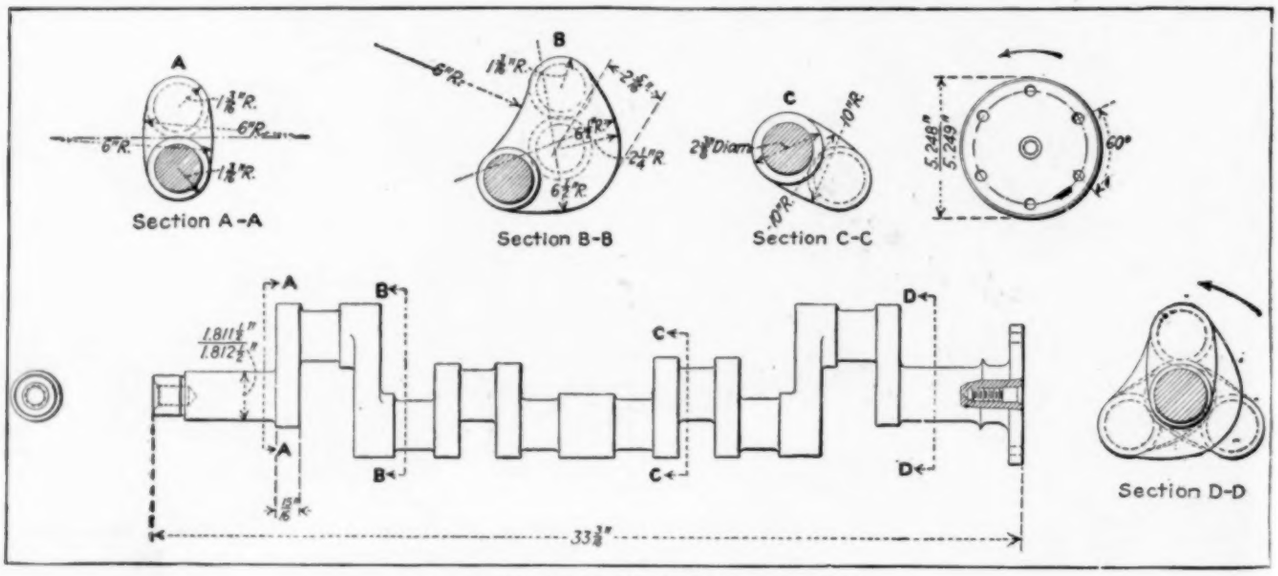


FIG. 3. TYPE OF CRANKSHAFT MILLED

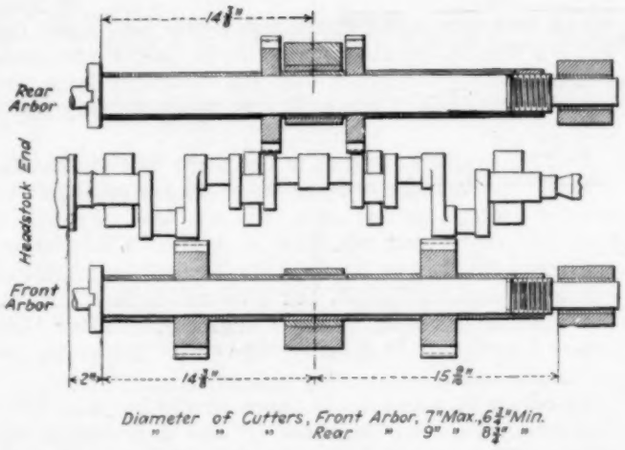


FIG. 4. CUTTER LAY-OUT FOR ASSEMBLY "A" MACHINE

taper shank of the arbor is fitted. A keyed shoulder on the spindle fits into a slotted collar on the arbor for driving purposes.

To make it easy to take out or replace an arbor, the middle rocker arm is made with a removable cap on the lower end. By removing this cap and sliding back the end rocker arm, the arbor and cutters may be removed from the driving spindle intact. Another duplicate set of cutters is put in place while the removed set is being ground.

As cutters are ground, they of course become smaller in diameter and some adjustment must be made in order to bring the cutting edges far enough into the work to remove the necessary amount of metal. This is provided for by means of an adjustable eccentric bearing for the cam roller. The adjustment will make allowance for about ¼ in. difference in the dimeter of the cutter.

Counterweighted levers keep the cam rollers in steady contact with the surfaces of the cams as the machine operates. A peculiar pointed projection or "rise" may be seen on the master cams. This is to throw the cutters free of the work so as to not interfere with its removal or replacement.

In order to make it possible to machine the entire periphery of the web and still throw the cutters back

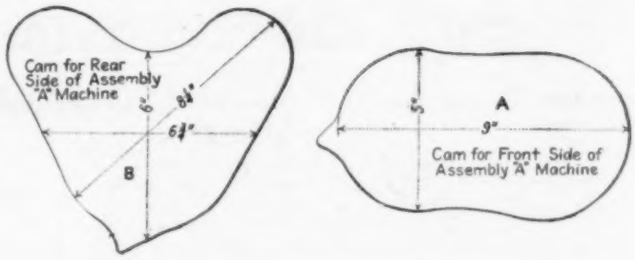


FIG. 5. CAMS FOR ASSEMBLY "A" MACHINE

clear of the work for removal, the work is made to travel ⅛ of a turn more than the cam. Then when the next crankshaft is put in the machine, it is set ⅛ of a turn further back than the previous one, which is easy to do on account of there being six equally spaced holes in the driving disk. By this plan no running or setting back of the cam or spindle is necessary.

The cutter spindles are driven through a series of gears so arranged as to allow the necessary movement of the rocker arms without disturbing the mesh of the gears.

One of the very difficult problems connected with the use of milling cutters on work of this character, is to eliminate all tendency to chatter. Few engineers who have not been up against just such a proposition, know how hard it is to solve. That the problem has, in this case, been successfully solved is proved by the smoothness and absence of chatter marks on the milled surfaces of the webs. This is especially remarkable considering the hardness of the metal, the natural springness of the crankshaft and the necessarily flexible drive through a series of gears.

Difficulties of this kind explain to some extent why the average maker of a standard line of machines does not care to build machines for special purposes. Only with a staff of engineers having special aptitude for the solution of unusual machinery problems and long experience in this field, will allow a firm to undertake such work without a cost almost prohibitive to the buyer.

The Lubricating System

The pumping arrangement supplying the lubricating and cooling systems, is shown in Fig. 7. Three Fulflo

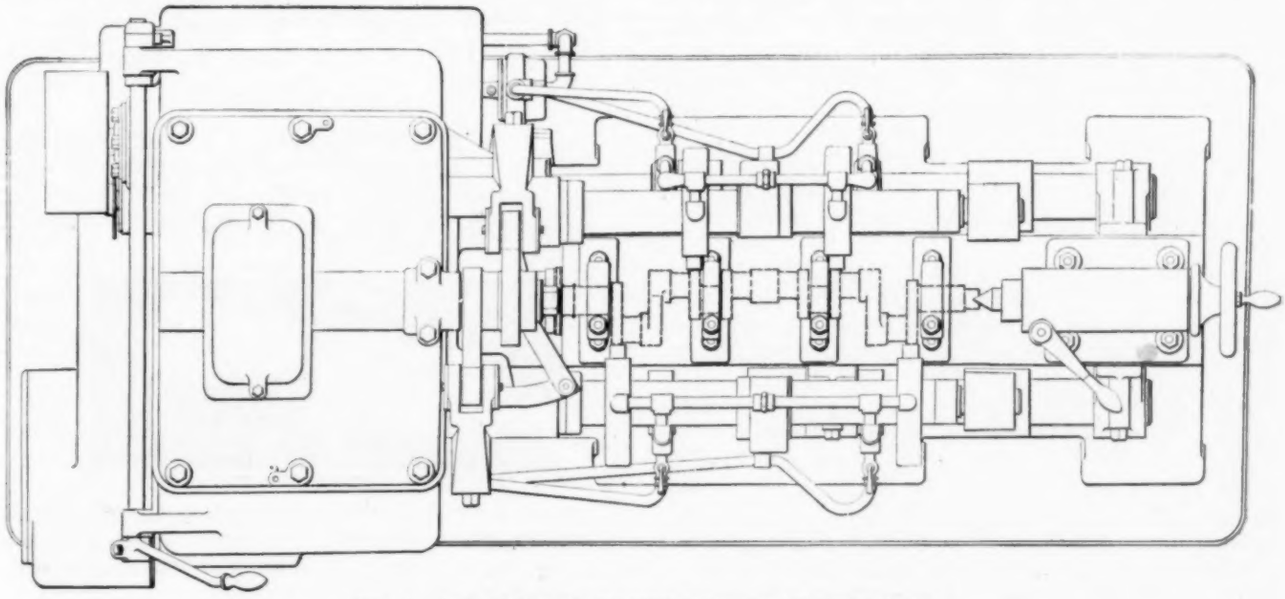


FIG. 6. TOP VIEW OF MACHINE WITH ASSEMBLY "B"

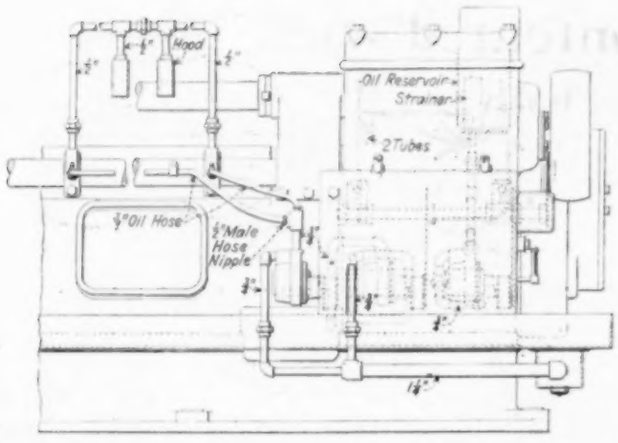


FIG. 7. DETAILS OF THE OILING AND COOLING SYSTEMS

pumps are used, each with a capacity of 15 gal. per min. This provides a pump for each two cutters and one for the lubricating system. The guards or hoods over the milling cutters are so made that the cutters are kept flooded with a large amount of coolant during the cutting operation. The lubricating oil is first pumped to a tank in the headstock from which it is distributed to the various bearings.

The machine has a shear pin in the driving pulley to prevent extensive damage should anything serious go wrong with the operating parts.

The machine occupies a floor space of 3½ x 8 ft., is 4 ft. high to the top of the headstock cover and weighs 8,000 lb.

What Is an Engineer Worth?

BY ENTROPY

If we are to accept the usual standard of valuation of the man who makes grow two blades of grass where but one grew before, the engineer should be considered on the same footing as the farmer. Does he get the proper reward for his services and if not, why not?

Apparently we are all of the opinion that he does not, but we are by no means unanimous as to why, nor as to how he is to get it. Workmen whose work would be much misdirected if it were not for the engineer have not allowed the smaller dollar to keep them from prosperity. Are we less smart than the bricklayer who makes our dreams visible? Why is it that a plasterer, a brakeman, or a horse shoer can demonstrate his value to the community and the engineer cannot?

One reason is that there is an over supply of engineering talent in the country. That is, there are more men who style themselves engineers than there is work for them to do.

How can the layman tell whom to employ? He sees some thousands of men of all ages wearing the A. S. M. E. pin. He sees engineering schools of good reputation turning out thousands of graduates. He knows that some of the members of the A. S. M. E. are high-grade engineers, and he knows that a good percentage of the graduates of the schools do well. He knows that a good engineer is not necessarily an old man, and he knows that if the young men do not get a chance that no new good engineers will develop, so he hires a graduate and puts him in a humble position in the drafting room. By and by the young man is given a real job to do and he comes through in good shape. He is well thought of, but only as a draftsman. He goes on in this way doing more and better work but not getting beyond the stage where he is looked upon as a cub engineer. His salary does not mount by leaps and bounds even though his ability is demonstrating itself very plainly.

So long as there are men in the ranks who are having a hard time to make a living wage we are not likely to see the average income go up a great deal. Frankly I feel that every man who has it in him to become an engineer should have the means to secure the necessary education and try it out, but I do not believe that all the graduates should stick to engineering after they have discovered that they are not likely to be successful at it.

Moreover it seems as if there should be more of a distinction between members of the engineering societies. There is I believe a grading of members of the A. S. M. E. but it is not indicated by any special insignia that is well known to laymen. If a man states truly that he is a member there is but slight concealment if he fails to qualify his statement by saying he is a *junior* member. The average employer of engineers, who is not himself a member of the society does not realize the difference and usually the question is not asked at all.

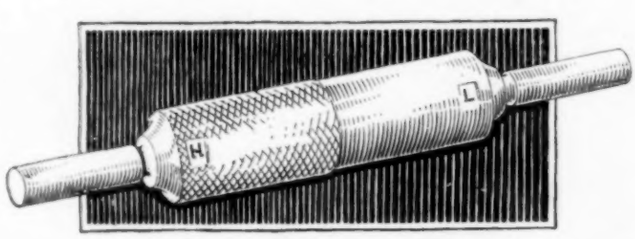
THE REMEDY—?

What are we going to do about it? Press agents cost money. We will have to learn press agentry and business management. We will have to learn that the treasurer is usually willing to pay for services that produce profit, but that he is neither an engineer nor a mind reader and he does not know when an engineer turns the tide of profits his way, nor does he know when we think we have done it unless we tell him. There is no reason for letting our light shine only in the bushel measure of the engineering societies. The good opinion of our fellow engineers is fine but it butters only an occasional parsnip. In fact it may be the very best advice to an engineer to occasionally get away from his kind and go out and look the world over. It is this outside world that has the money to pay for engineering and it has good jobs to offer while engineers have only the leavings, the undesirable jobs, to hand to each other.

A Plug Gage Easy to Use

BY W. A. ANDERSON

The sketch illustrates a method of facilitating the use of a high- and low-limit plug gage. The high-limit end of the gage handle is knurled and the low-limit end is left smooth. This, of course, enables the inspector



to tell by the feel of the gage which is the high limit and which the low limit end without referring to the markings on the gage. This method has proven very successful in actual practice.

Keeping Workers Contented with Two-Pay Envelopes

By FRANK C. HUDSON

This article tells of a plan which automatically takes care of the advance or decline in the cost of living, based on Bradstreet's reports. It leaves the basic wage as before and meets increased costs of living by special payments.

ONE of the great objections of many managers to the large increases in wages which have taken place during the past four years has been the setting of a new standard which will naturally linger in the minds of the workers, even should the cost of living again resume somewhere near its normal level.

The Oneida Community, Ltd., Oneida, N. Y., considered this phase of the problem during the early part of the war period, and decided to adopt a two-envelope plan of paying wages. The basis for this was the contention that the value of the work done was no greater than before, and consequently the price paid should remain the same. They recognized, however, that workers must have more money to meet the increasing expenses, and the second envelope, known as the H.C.L. envelope, contained an amount sufficient to make up the difference in the cost of living between pre-war times and the date at which the payment was made.

A careful estimate, applied to the living expenses of a large number of families of differing size and income, indicated that the increase in the cost of living in their community during the year 1916 was 16 per cent. They therefore announced that during the war and until a period of settled prices had been reached, basic wages would be left as at that time; that additional payments would be made equal to 16 per cent of the regular wage, but that this would change each month, according to Bradstreet's index numbers of about 100 commodities, on the basis that every 20-point change would mean a change of 1 per cent in the cost of living.

Every Man Knows What to Expect

These index numbers were posted each month on the factory bulletin board, together with the change of wages indicated for the following month. These fluctuated somewhat, but there has been a constant increase (with a few downward fluctuations) from 16 per cent in January, 1917, to 49½ per cent for February, 1920. It is not contended that this is an absolutely perfect system, but the fact that more than 2,000 workmen, after three years' experience, agree that the H. C. L. envelope has fully covered increases in their living cost, adds confidence to the practical value of this method and the figures used.

One great advantage of this plan has been to do away with all periods of wage discussion, which are both disorganizing and depressing when left to ordinary methods. This plan takes care of all changes in living costs automatically, relieving the minds of the workers of all anxiety and controversy from this source. The result has been to combine security and contentment for employee with financial safety for the firm itself. This plan has proved beneficial in securing the spirit of enthusiastic co-operation from the employees who feel sure that no matter how high living costs go, the wage increase will automatically keep pace with them.

Those who contend that while such a plan might work in a period of advancing costs it would be resented when any lowering of the total payment became necessary, will be disappointed to learn that this is not the case. There have been several changes downward, and the attitude toward this automatic reduction is reliably reported to be everything which the most enthusiastic believer in industrial partnership could desire.

As originally worked out, both employees and managers who received more than $2,000 per year received the H. C. L. percentage upon only $2,000. This, however, was shown to work a hardship on some, since their expenses were increased on a basis more nearly proportionate to previous expenses than at first appeared. This was therefore revised to meet the H. C. L. percentage on $2,000 plus one-half of the balance of their salaries.

Increased Product Per Man

While it is probably true that many of the employees do not thoroughly understand the exact significance of the index number as published by Bradstreet, they do realize that the changes in the index number, and consequently in the amount in the H. C. L. envelope from month to month, correspond very closely to changes in living expenses. Furthermore, they understand that the managers of the company have absolutely nothing whatever to do with determining the index figures, and consequently that they are not responsible for any increases or decreases which may come.

The great test, both of the plan and of the way in which the plant is managed, is that in spite of the general unrest there has been no labor trouble, and the industrial family has pulled together even better than ever before. In distinct contrast with those who claim that their men are producing less than during the period of lower wages, the product per man of the Oneida factories has increased. It is also interesting to note that there is less spoiled work due to the human element within the control of their own co-operative effort. They do, however, find it more difficult to get pre-war standards of workmanship and quality in some supplies and raw material.

The H. C. L. envelope was not designed as a permanent institution. It has served as a bridge to carry a much more ambitious plan of industrial partnership across the difficult period of the war. Whether, as some hope, it will form the basis for a permanent system of automatic wage readjustment, remains to be told. The words of the general manager, A. M. Kinsley, are particularly significant:

"All in all, it isn't what you do any more than it is the spirit in which you do it."

A Mutilated Gear Feed

By WILLIAM GUMPRICH, M. E.

The Geneva stop, both in its original and modified forms, has long been used for intermittent motion. A modification that appears to be novel is described and illustrated in this article. The method of arriving at the angles of intermittence is also given.

MANY different mutilated gear motions have been designed and applied practically on various machines in order to give a definite amount of repeated motion in the same direction to some mechanism. To such motions the engineer generally has recourse when neither Geneva nor ratchet motion, derived either from a crank or a quick return motion, will just fill the conditions required by the problem on hand.

To my knowledge this problem has in the past been only partially solved. Either the motion was designed for speed, and then of necessity very weak, and could not be called upon to deliver great power, or else it was constructed for power and had to be made so strong that the weight made high speed prohibitive. In the first instance the motion is generally picked up and brought to rest by letting the gear teeth get in and out of mesh, using some locking arrangement to hold the driven gear in position during the dwell for a correct pickup on the next cycle. It is readily to be seen that this design is only applicable for lightest constructions, because the gear teeth which take the shock of the pickup would hardly stand up under severe conditions.

In the second case the pickup is always aided by some starting cams which mostly take their basis of design from gear tooth action. The sliding friction as inherent to this action is of course still present and the starting angle cannot be very much increased. In order to insure against the inevitable wear of a light construction, these gears and cams are always made very heavy.

The Geneva motion is limited to a minimum of four slots. The lower the number of slots chosen, the greater is the decrease in the power of efficiency. This is due to the fact that the length of the slot changes the leverage from maximum at the beginning of the motion to a minimum which is reached when the driving roll passes the common center line or when the acceleration has reached the highest point.

The construction shown overcomes these bad features to a great extent. The assembly Fig. 1 shows a mutilated gear drive with a modified Geneva motion of ⅓ index of the gear to every revolution of the driver.

Let us consider as assumptions in this case:

Center distance 7 in. and ratio of r.p.m. of driver to r.p.m. of gear as 3 to 1. The requirements call for a powerful yet speedy drive and a lock during the dwell sufficiently accurate as not to require any additional gaging devices outside the mechanism itself. A Geneva motion is out of the question on account of the power loss at maximum speed; even if the physical solution were possible.

In order to determine the correct data it is necessary to assume a preliminary angle for the starting roll which we will take at 60 deg. In order to make the starting motion as easy as possible we next discard the customary practice of letting the center line of the Geneva slot run through the center of the gear. We shift the position of the driving roll enough toward the center of the driver to have the long cathede of the triangle (formed by the common center line, the center line of the driver and roll, and the center line of the Geneva slot) run past the center of the gear in advance of the direction of motion. Let us further assume that other operations make a dwell of 150 deg. necessary. Then we will have the following preliminary timing:

Driver:		
60 deg	.....	Starting
60 deg	.....	Stopping
150 deg	.....	Dwell
90 deg	.....	Gear feed
360 deg.		

The pitch line speed during gear feed has, of course, to be high enough to revolve the driven gear so as to leave it in position to bring it gradually to rest again after ⅓ revolution. From the preliminary layout it can be seen that the starting angle of the gear is less than 30 deg. on account of the angularity of the slot. We therefore will assume an approximate timing for each cycle of the

Mutilated gear:			
	25 deg	.....	Starting
	25 deg	.....	Stopping
Leaving	70 deg	.....	Gear feed
	120 deg.		

This gives us a ratio for the actual gear drive of 9 to 7.

The next factor to be settled is the pitch of the gear-teeth. We will choose six pitch as strong enough to carry most mechanical motions that do not call for an excess of strength in construction.

With the center distance already established as 7 in. the ratio of 9 to 7 does not prove practical with six pitch gears. We therefore readjust our ratio and select the nearest suitable one, which will be 8 to 6. We will now proceed to make the necessary correction on our assumptions based on this new ratio:

Our pitch circles are now

Driver 6 in. with 36 teeth in whole circumference
Gear 8 " " 48 " " " "

With this we have established an absolute basis from

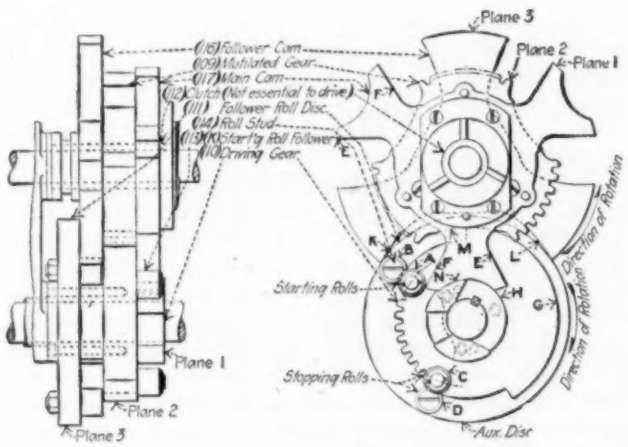


FIG. 1. ASSEMBLY OF GEARS GIVING AN INTERMITTENT MOTION OF THREE INDICES

which the entire problem can now be worked out successively.

Since the mutilated gear has to be brought from rest to pitch line speed and vice versa, it is advisable, even

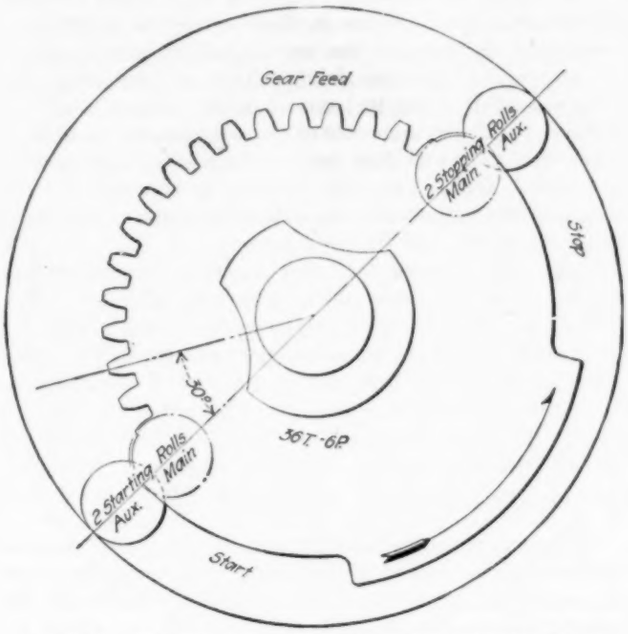


FIG. 2. DRIVER FOR INTERMITTENT MOTION OF TWO INDICES

necessary, to mount the main rolls *A* and *C*, with starting and stopping functions respectively, on the pitch circle of the driver. Furthermore, since the starting and stopping speed of the gear has been decreased through the angularity of the Geneva slots, giving a value of practically zero for the first 5 deg. of starting and the last 5 deg. of stopping, the starting and stopping time of the driver can be reduced to 55 deg.

With the starting roll *A* at 60 deg. from the common center line, next complete a rectangular triangle with the center line as hypotenuse. The long cathede of this triangle will cut the pitch diameter of the mutilated gear at a point which, upon inspection, will be found to be 22 deg. 30 min. We have now established the following timing:

Driver		Mut. Gear	
55 deg.	Starting	22 deg., 30 min.	Starting
100 deg.	Gear feed	75 deg.	Gear feed
55 deg.	Stopping	22 deg., 30 min.	Stopping
150 deg.	Dwell		
360 deg.		120 deg.	

which is the timing required.

The next consideration is how to escape from the Geneva slot after pitch line speed is attained, and how to pick up with the Geneva slot at the end of the gear feed and bring the gear to rest. Naturally we will want to keep our mechanism controlled at all times to enable us to turn forward or backward without losing our timing, and also to prevent any damage which is liable to occur with a motion that is not positively controlled. If it were not for this, just a half Geneva slot as represented by faces *E* and *F* would satisfy the other conditions.

It is evident that the farther a given point is removed from its center of motion the greater will be the distance it travels for each given amount of angular speed. Therefore we put a second set of rolls at the same angles as the starting and stopping rolls, but a certain distance farther from center and describe cam curves tangent to the travel of their outside during the starting and stopping motion. We thus obtain surfaces which practically constitute second sides to the already existing halves of the Geneva slots *E* and *F*. Since these outer rolls travel at greater surface speed than the pitch line velocity, they will travel away from their cams when the gear teeth pick up the motion. It is only a question how far to bring them out in order to clear the outer edges of the cams after the gear teeth have engaged. This interference will occur at approximately 50 deg. of travel under gear feed. In our case the distance between inner and outer rolls is exactly 1 in. and the outer rolls will clear the cams by approximately $\frac{1}{8}$ in.

The operation of the mechanism as shown in the assembly is as follows:

The dwelling cams *G* and *H* are just releasing the mutilated gear at the circular cut-outs *M* and *N*, their rear edges just passing over the center line. This is taken as the zero point. Rollers *A* and *B* are just making contact with the starting surfaces. During the next 55 deg. the mutilated gear is gradually brought up to pitch line speed. When the rolls pass over the center line, the first tooth of the driver picks up the first tooth of the gear. Theoretically the rollers leave their surfaces at this point. Under practical construction, however, this will not take place until the next teeth also have engaged, lending their strength to the drive. The gears alone now do the work until rollers *C* and *D* pass over the center line and pick up their cams just when the last teeth lose contact. During the

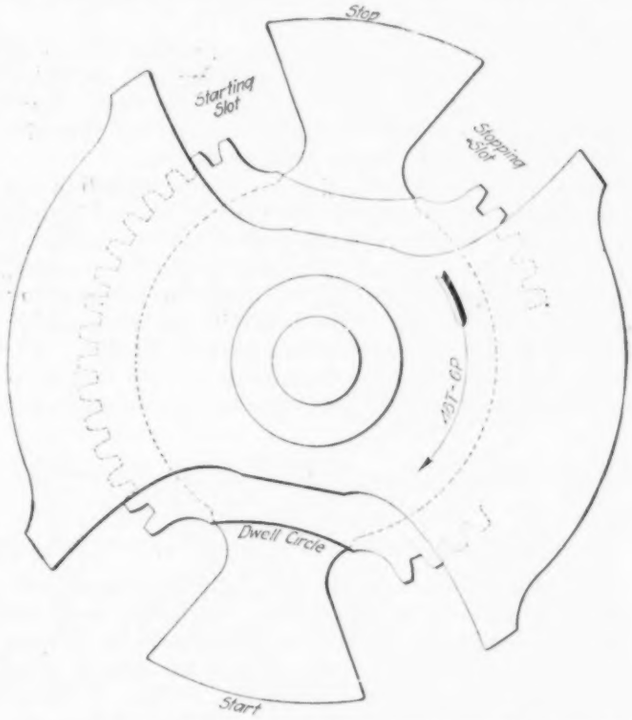


FIG. 3. MUTILATED GEAR FOR INTERMITTENT MOTION OF TWO INDICES

next 55 deg. the mutilated gear is gradually brought to rest again and then the dwelling cams *G* and *H* will hold the gear at rest during the dwell of 150 deg. It is advisable to have the double-dwelling lock this construction affords, partly on account of accuracy, partly on account of better wear resistance.

The hubs of the driver have, of course, to be cut out for clearance for the cam edges of the mutilated gear.

The construction is arranged in three main planes. Plane 2 in the center represents the two gears carrying the teeth and one of the dwell locks, *G* and *M*. Fastened to the driving gear 110, but in plane 1, are the main rolls *A* and *C*. Here it may be noticed that all teeth have been left off, both on the driver and on the gear that would have given interference; and the remaining gear teeth were so located as to allow a maximum of metal for the insertion of the roll stud 115. Plane 2 also takes in the main cam 117 with the second dwell lock consisting of cam *H* and dwelling circle *N*.

Attached to the rear of the driver is the follower disk 111, separated from it by a hub. This disk carries the two follower rolls *B* and *D*. These rolls lie in plane 3, together with the follower cam 116, with surfaces *K* and *L*.

Both units are machined separately in their several component parts, and then securely fastened together by means of dowels and filister-head screws reaching completely through. The driver is keyed in its entirety to the shaft. The mutilated gear here is shown assembled on one bushing and transmits power to its shaft by means of a clutch. This unit can of course also be keyed to its shaft instead.

This motion has successfully been run as high as 400 r.p.m. of the driver without undue vibration or knock, and the writer believes if very carefully fitted, that this speed can be bettered.

Its greatest advantage is the flexibility in design, as almost any combination in timing is possible, its strength and speed, and the accuracy possible in the locking during the dwell.

The flexibility of the design is somewhat shown in Figs. 2 and 3 where we have a driver and mutilated gear for two indices, where the smaller amount of dwell and the greater amount of gear feed are the only differences in detail from the three-index type.

In concluding, let me add a few words regarding the modification of the Geneva stop motion, which I believe is novel. It is not generally known that by inclining the slots in the direction of motion of the Geneva disk, the starting motion can be retarded and the stopping motion accelerated, and that naturally the reverse holds true by inclining the slots against the motion. The writer has availed himself repeatedly of this fact when particular reasons made a quick start or stop advisable.

Why Not Industrial Motion Pictures?

By John A. Honegger
President of the Production Engineering Co., New York

Recently the writer witnessed a motion picture, produced by the Ford Motor Car Co., which illustrated the various occupations taught to the inmates of the Federal Prison at Atlanta, Ga. The picture brought to mind the question used as the title of this article. Further, why not have a center in every city where technical men could gather to witness the various manufacturing processes of, say, motor cars, cash registers, typewriters or of any other product that might interest them?

The pictures could be produced and distributed in the same manner as present-day photoplays are. There would be the producing company, which would visit the various plants and photograph the processes or machines. The films would then be turned over to the distributing agencies, which in turn would distribute them to the various cities for use. The theaters exhibiting the pictures would charge an admission fee, just as is done for pictures at present.

The writer believes that there is a sufficient number of technical men in the various cities to enable the owners of theaters to receive a good return on their investment. If the admission charges did not cover the expenses of the theater, considerable income could be derived by advertising the various machines, tools, and other mechanical devices now on the market. Stereopticon slides, such as are still in use in the majority of theaters for announcing the following week's entertainment, could be used for this purpose.

It is a well-known fact that motion pictures of machines in action have often influenced the purchaser toward buying. In country places far distant from the home plant, motion pictures have accomplished more toward selling machines than a whole staff of salesmen. The reason for this is obvious. The motion picture is the eye of the world and it records truthfully the actual performance of an act.

Benefits of Industrial Movies

With reference to industrial motion pictures the advantages to be gained by technical men, shop men, and the engineering profession in general by their use are many.

For the manufacturer, they would advertise his products more extensively without additional cost and would reach the people most interested. The engineer would be able to study at leisure the various processes of manufacture, routing, sequence of operation and the machines and tools used. In addition to this, he would see what his fellow engineers have accomplished.

Like the engineer, the designer would become mechanically more broad minded. He would be able to study and analyze the why and wherefore of the various mechanisms and operations. The production engineer, factory manager, superintendent and foreman would all find things of value in the pictures. The man at the bench or machine would learn new kinks in his work and through that become a more efficient and productive worker.

Possibly the apprentice would be the one that would gain the most, for the reason that we become adapted to doing certain things by seeing them done and then trying to imitate the operations. If the studies in technical schools and colleges would be co-ordinated with motion-picture lectures, the students could gain a far better fundamental understanding of the subjects and be in a better position to tackle the every-day problems encountered in actual practice.

All this will tend to knit the engineering profession together into a great organization of more efficient and productive workers. The public in general, who are the actual consumers of the products manufactured, would gradually come to understand that there are very few products manufactured which at some time or other have not been in the hands of an engineer. As for foreign trade, if salesmen were equipped with reels showing the activities of industry in America, it would not be a very hard proposition for manufacturers to sell their products in every country in the world. The writer would like to hear what other subscribers to the *American Machinist* think of this idea.

Elements of Gage Making—X*

BY C. A. MACREADY

Angular gages as a rule are required to be much more accurate than the usual run of angular work done in the toolroom. The use of the sine bar facilitates the handling of such gages to the required high degree of accuracy.

(Part IX was published in our July 22 issue.)

THE sine bar, *A*, Fig. 120, shown in two different positions at *B* and *C*, becomes the longest side of a right-angle triangle and as the center distance between the two 0.5-in. cylindrical plugs *X* and *Y* can accurately measured, this distance is what is known as a constant. This constant multiplied by the sine of the desired angle gives the vertical height that one of the cylindrical plugs *X Y*, must be above the other. The center to center distance *X Y* in the sine bar *A*, is 5.00 in., but it might have been 5.0012 in., 3.10 or 1.0 in. Whatever the center to center distance is it becomes the constant to be multiplied by the sine of the desired angle. Often because of limited space short sine bars have to be used. Such sine bars, if temporary, are made by attaching the buttons shown in Fig. 19 to a square and parallel piece which is not necessarily hardened. These buttons must be placed accurately parallel to the edges of the bar but they need not be central between the edges. This facilitates setting the buttons by using a parallel piece to rest them on when tightening the holding screws. As stated before, their center to center distance becomes the constant to use and this distance should be, if possible, a unit in order to have as few figures used as possible and thus save time. For instance, 5.0 in. is preferable to 5.0012 in. and 1.10 is better than 1.1125 in.

For a permanent bar the one illustrated at *A* in the top view, is a convenient one to use. The $\frac{3}{8}$-in. slots and holes provide means of attaching it to an angle iron and permit the use of magnetic force to hold the work without clamping. When grinding the bar the principles described in Fig. 78 *A* are used. When fitting the plugs they should be able to take the "set" described in article III, to hold them in place. The setting of the sine bar will be taken up later.

MAGNETIC ANGLE IRONS

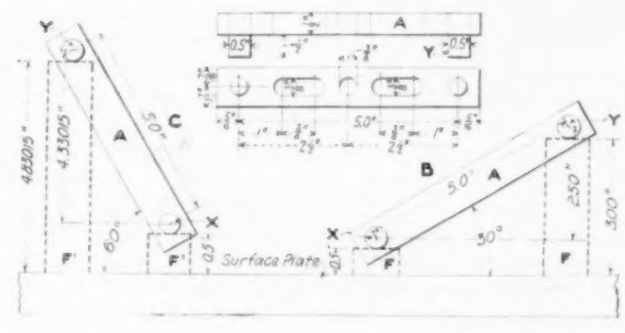
When duplicating work the use of clamps is often the cause of errors. The pressure of the clamps being local and variable causes a variation in seating the work. Magnetic pull being practically unvarying upon all surfaces in contact with the poles provides a very uniform holding medium and should be taken advantage of whenever possible. The principle used was described in Article V, Fig. 75, and the originating of the master angle *A*, in Fig. 75, can be used in place of the hexagon which will be described later.

The angle iron *A*, in Fig. 121, is a very handy one and should be hardened, ground and lapped 90 deg. upon the edges and faces as described in connection with making a proved 90 deg. angle in Article VI. This permits the use of the edges when setting the sine bar to an angle greater than 45 deg.

It will be noticed in Fig. 120 that the sine bar is set in two different positions or angles. The fact that the differences between the sines of the angles becomes less and less as 90 deg. is approached makes the use of the cosine of the angle a more accurate function to use than the sine. It also permits the use of shorter measuring seats for the sine bar plugs to rest upon. As the edges of the angle iron are at 90 deg. to its base this permits the angle to be proved by using both the sine and cosine of the angle to be set up. It will be noticed that the seat *B*, Fig. 121, held by the brass screws, is only finished upon the bottom and top which are ground parallel, the surface of the work seat is then finished to 90 deg. and to approximately the angle wanted. No attention is paid to the other surfaces as they are not used. The sine bar is placed so that either an edge or the bottom of the angle iron can be used to seat upon a surface plate. Two "Planer tool-setting gages" illustrated in Fig. 4, are adjusted to the proper height upon which to rest the 0.50-in. plugs in the sine bar. Then the sine bar is attached by screws through the slots in it and the angle iron. The sine bar is now in the position shown at *C*, Fig. 120. The angle iron is placed upon one of its sides to use the cosine of the angle wanted to prove that angle. The sine of 30 deg. is now multiplied by the center to center distance of the plugs *X Y*, giving us the measurement in diagram *B*.

The distances given in *B* and *C* are from the centers of the 0.5-in. plugs. As these plugs must be the same size their bottom surfaces can be used to seat upon the planer gages *FF* and *F'F'*. One of the pair of planer gages used should be set approximately to the lowest distance that can be used, in this example 0.5 in. This added to the required vertical height, 2.50 in., makes the other gage measurement 3.0 in. The vertical height of 4.83015 in. in the diagram *C* is the sum of 4.33015 in. plus *F* (0.5 in.) = 4.83015 in.

The clinging of two smooth surfaces in contact such as the bottom of the planer gages *FF* and the surface plate often gives a false feeling of contact with the



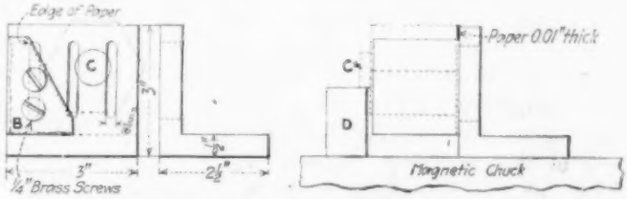


FIG. 120. THE SINE BAR AND ITS USE. FIG. 121. SET-UP FOR MAKING A HEXAGONAL GAGE

*Prepared for the Author's forthcoming book, "Elements of Gage Making."

0.50-in. plugs when testing their height. After setting and attaching the sine bar to the angle iron, the planer gages *FF* are removed and set 0.0002 in. full, i.e., 3.0002 and 0.5002 in. A reading is set at zero over the 0.5-in. sine bar plugs after the planer gages are withdrawn. When the planer gages are replaced under the plugs, this 0.0002 in. should show if the gages *FF* are properly in contact with the 0.5-in. plugs.

Having proved the angle the bedding piece *B*, Fig. 121, is now attached to the angle iron and in contact with the sine bar which is then removed. With all the precautions that can be taken when setting the sine bar, errors will creep in when grinding work. If one depends altogether upon the setting of the bedding piece *B*, and the work seating itself properly, errors will be found if the angles are tested with a knife edge straightedge set at the proper angle as shown in Fig. 122 at *B'*.

The hexagon shown with numbered sides in Fig. 122 and in dotted lines in grinding position in Fig. 121, is required to be as near perfect as it is possible to make it. It provides an excellent example of grinding angles and locating seats. The bed *B*, Fig. 121, is very plain, the cylindrical seat *C* resting upon the bedding block *D* is used to measure from, so that the angular sides will be equidistant from the center. The piece *C* may be a plug in a hole, or a disk soldered on the end of the work.

The start of this hexagon is made from the sides marked *1* and *2* in Fig. 122. These are ground parallel to each other and the proper distance from C. The side *2* is then placed against the bed *B* in Fig. 121, and the side *3* is then ground. Side *4* is now ground parallel to side *3* and the proper distance from *C*. Either side *3* or *4* can now be used against the bed *B* to grind sides *5* or *6*, which are made parallel to each other and so finish the grinding of the angles. As the top and bottom surfaces have been made parallel they are used to prove the sides 90 deg. vertically. The top and bottom surfaces are also used to locate the hexagon when being tested with the knife-edge *B*, in Fig. 122. The principle used is one that is often used when originating a 90-deg. angle block. That is: all angles if alike will prove themselves from any side.

To use this principle the angle tester must be maintained at a constant angle when testing angles below or above 45 deg. This is accomplished with a surface plate that has a parallel *D* attached to it. This parallel is used to locate the work and testing fixture at a constant angle. To set the straightedge *B'* at the proper angle the sine bar is set in a position and at the proper angle to expose an unobstructed view to set the straightedge *B'*, as shown in the view at the right. The front and back edges of the angle iron *F* must be parallel. The front and the back edges of the angle iron *E'* need not be parallel as both angle irons are placed against the parallel *D* when adjusting the straightedge *B'* to the sine bar. If the edge of the angle *F* is not parallel with the face a compound angle will be the result of the angle copied from the sine bar by the edge of *B'*. As the angle iron *E'* is maintained at a constant angle by the parallel *D*, when the straightedge *B'* is adjusted it is obvious that it will maintain that angle and be a duplicate of the setting of the sine bar.

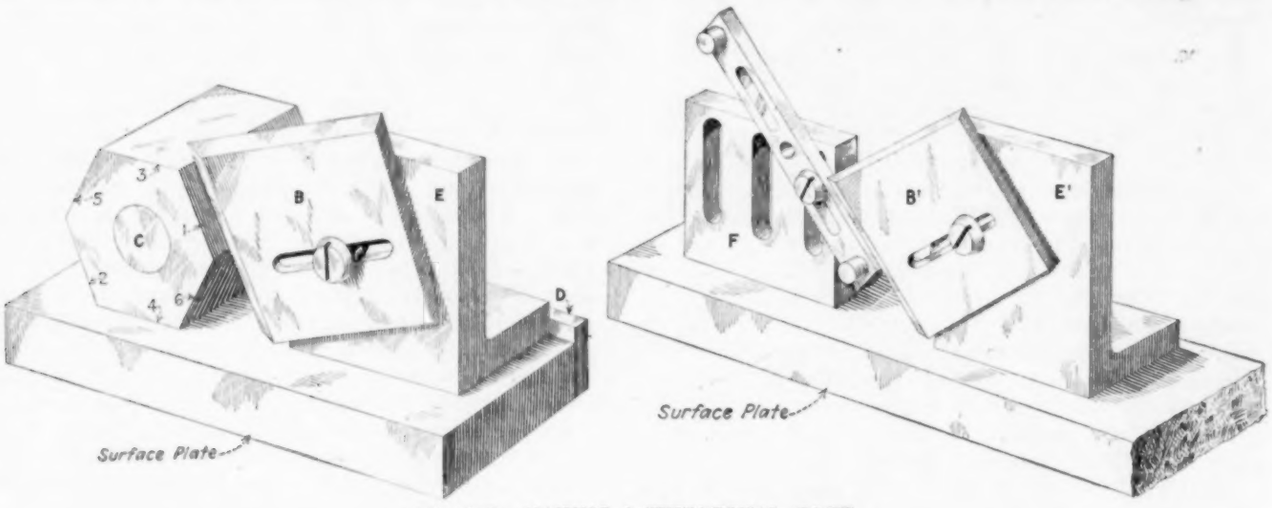


FIG. 122. MAKING A HEXAGONAL GAGE

To test the hexagon it is placed against the parallel *D*, as shown in Fig. 122, and the straightedge *B* is placed in contact with each side in succession. The hexagon is then reversed, using the opposite face to bed against the parallel *D*. If the angles are correct they will, when reversed, shut out light when tested from each angular surface. For a temporary fixture a micrometer head can be attached to the surface plate and used as described in connection with Fig. 124. The micrometer head holder shown in Fig. 123 can be attached to different machines and measurements taken of the movement of the tool or carriage when desired.

The angle comparator and originator illustrated with details in Fig. 124 shows the completed design of the

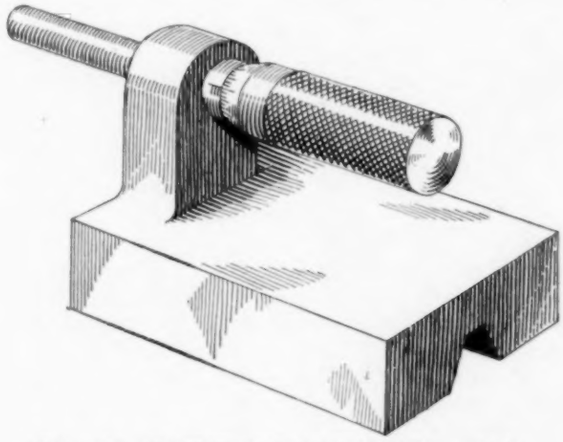


FIG. 123. HOLDER FOR MICROMETER HEAD

temporary device illustrated in Fig. 122 at *A*. The addition of the cylindrical plugs *13*, Fig. 124, and the micrometer head allows the angle to be found by using the sine bar principle, described in connection with the sine bar. This device will also determine the parallelism of the angular sides to the axis of the piece. The use of the micrometer prevents wear of the straightedge when the angles are tested for parallelism. An indicator can be used but this will not show the *amount*, which often is small, that the sides are out of parallel. The use of parallel cylinders, or rolls of different sizes, allows an unknown base of a triangle to be computed from the size of the cylinder used in contact with one of its sides. The cylindrical parallel is also used as a direct seat for the work when testing the other side of an angular piece for parallelism. The cylinder should be long enough to locate the work positively. The diameters of the cylinders should increase by even decimals, about 0.062 in. between sizes up to 0.374 in. to facilitate computing and movement of the micrometer screw. Let us take the triangle *D* in the assembly drawing of Fig. 124, as an example to demonstrate the accuracy of this method of measuring the height of the apex *X* above the base *A* of the triangle *D*, one side being in contact with the parallel cylinder *8*. Any diameter of cylinder may be used provided it is not greater in diameter than twice the altitude of the triangle being measured. However a cylinder just twice the altitude is the ideal cylinder, but smaller ones can be used.

Taking the foregoing empirically and the following also: When the apex or altitude of the triangle *D* is at the right height, if the side *B* is projected in the direction *E* it will touch the circumference of the cylinder *8* and the point of contact will be vertically above *C* and the same distance above the center of the cylinder *8* that *C* is below it. A knife edge straightedge, shown in dotted lines, can be used for this test if the fixture is not to be had. When using the sine bar fixture, Fig. 124, with the correct cylinder the sine bar straightedge *6* is set at the angle wanted and in contact with the cylinder. The micrometer is set to read zero when in contact with the straightedge holder *4* and direct readings can then be made upon the micrometer scale. As an example: The prism *D* has been roughed down to size and the amount to take off to finish it to size is found by placing it in contact with cylinder *8*, which is 1 in. in diameter. The micrometer having been adjusted to read zero with the straightedge in contact with the cylinder, the amount that the prism is large in a line parallel to the base can be read directly upon the micrometer when the prism is placed in contact with the cylinder. This amount can be taken from any side of the prism to make the apex the right height. To prove that too much has not been taken off a known thickness is placed between the prism and the cylinder and it should show the same thickness when measured by the increased size of the prism.

The straps *7*, should be placed to give a pressure towards the back piece *3*. The "goose neck" should be strong enough to resist the wedging and lifting effect of the angle of the prism. The more acute the angle the greater will be the wedging effect which will tend to raise the cylinder from its seat upon the bedding piece *1*. End plate *3* must be at right angles to side plate *2*.

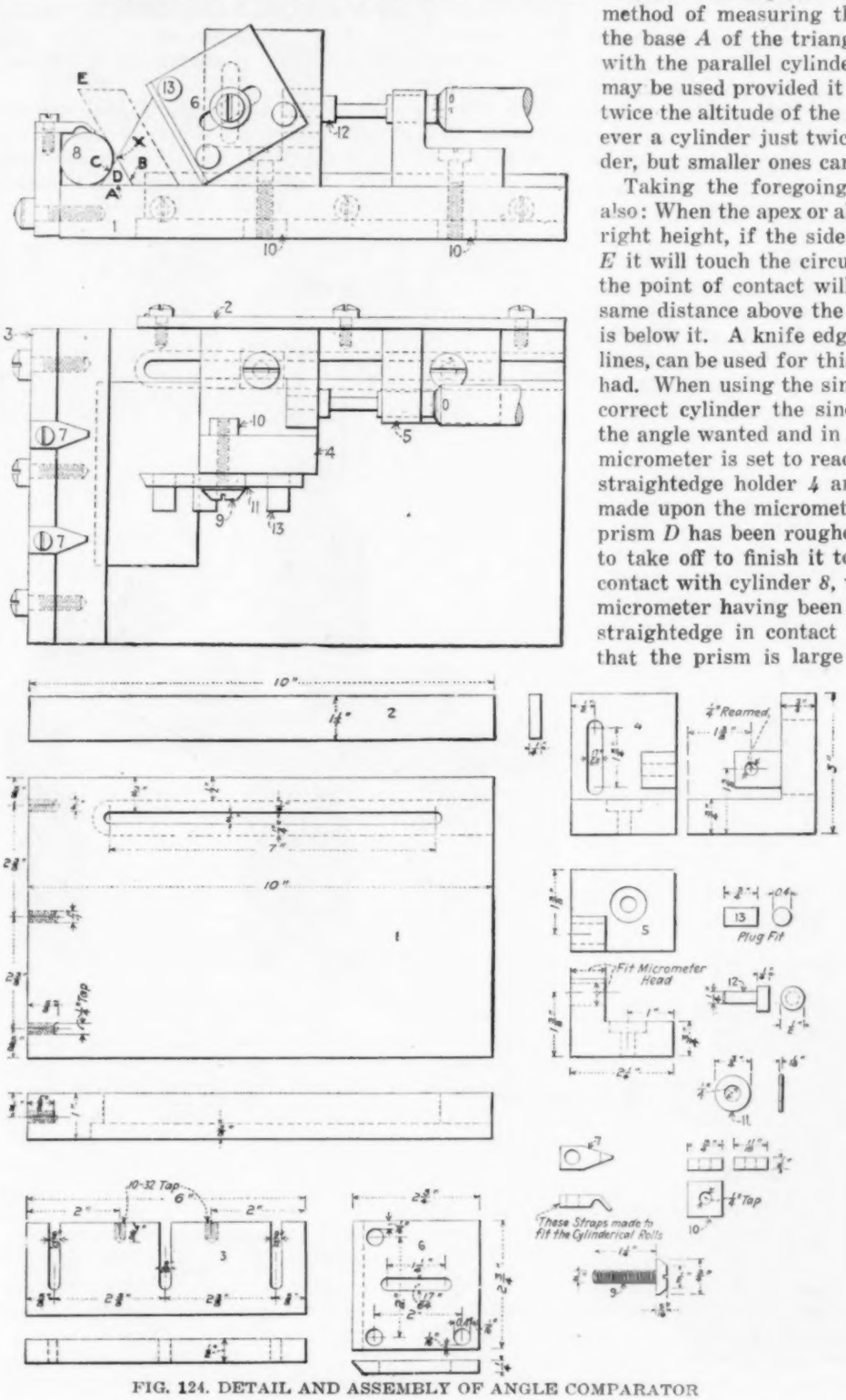


FIG. 124. DETAIL AND ASSEMBLY OF ANGLE COMPARATOR

Metalwood Crankshaft-Straightening Presses

By J. V. HUNTER
Western Editor, *American Machinist*

The automotive-engine crankshaft is forged to fairly close limits, thus saving both stock and machining time. It is essential that, before machining, it be carefully straightened, and the presses here described are built to expedite this work.

A LINE of hydraulic power presses for straightening drop-forged automotive-engine crankshafts has been developed by the Metalwood Manufacturing Co., Detroit, Mich. These presses are now built in several types and range in capacity from 20 to 65 tons working pressure, with table lengths suitable for the size of the work upon which the press will be used.

The character of the press used for crankshaft straightening depends somewhat upon the method employed in the drop-forge shop. The flanging operation in forging is usually followed by reheating and straightening of the crankshaft under a 2,500-lb. steam-operated drop hammer; and then the shaft goes through the regular heat treatment. The centering operation follows, and the crankshaft is then ready for straightening.

The straightening machines employed for this work are of several types, both power- and hand-operated presses being extensively used. The former type is used principally in the larger shops where large quantities of work are handled, or in cases where peculiar shapes of crankshafts require considerably more straightening due to greater distortion during heat treatment. The more simple forms of shafts come from the re-strike operation of forging so true that they require comparatively little straightening, provided they have been subjected to proper methods of heat treatment. For such cases the hand-operated type of straightening press is entirely suitable. The usual limit of eccentricity allowable, when correcting the irregularities of a rough-forged shaft on the straightening press prior to the machining operations, is only $\frac{1}{32}$ inch.

Fig. 1 shows a No. 191 Metalwood straightening press, equipped as a self-contained, motor-driven unit. This type is built in two other forms, either belt-driven from a line shaft or for connection with an accumulator pressure supply as shown in Fig. 2.

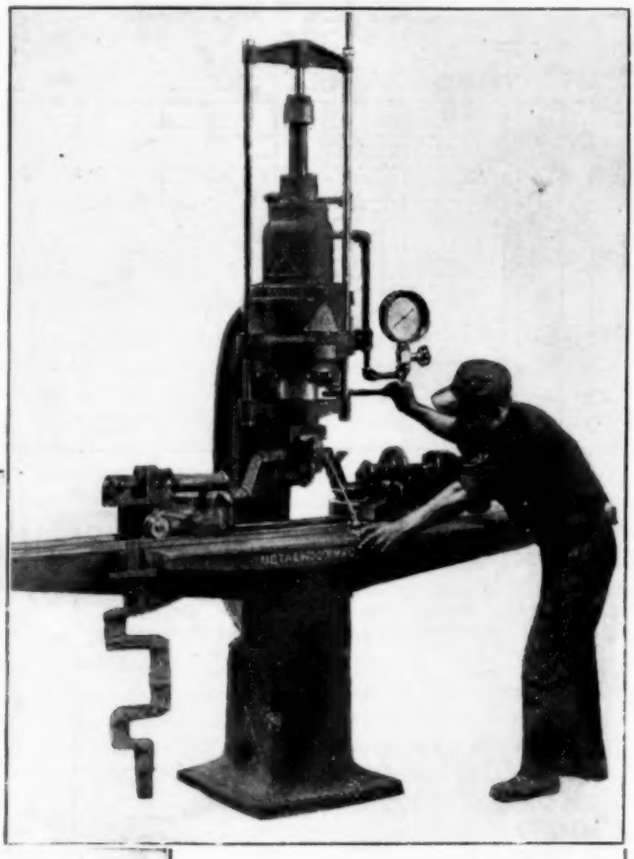


FIG. 1. METALWOOD NO. 191 MOTOR-DRIVEN CRANKSHAFT-STRAIGHTENING PRESS

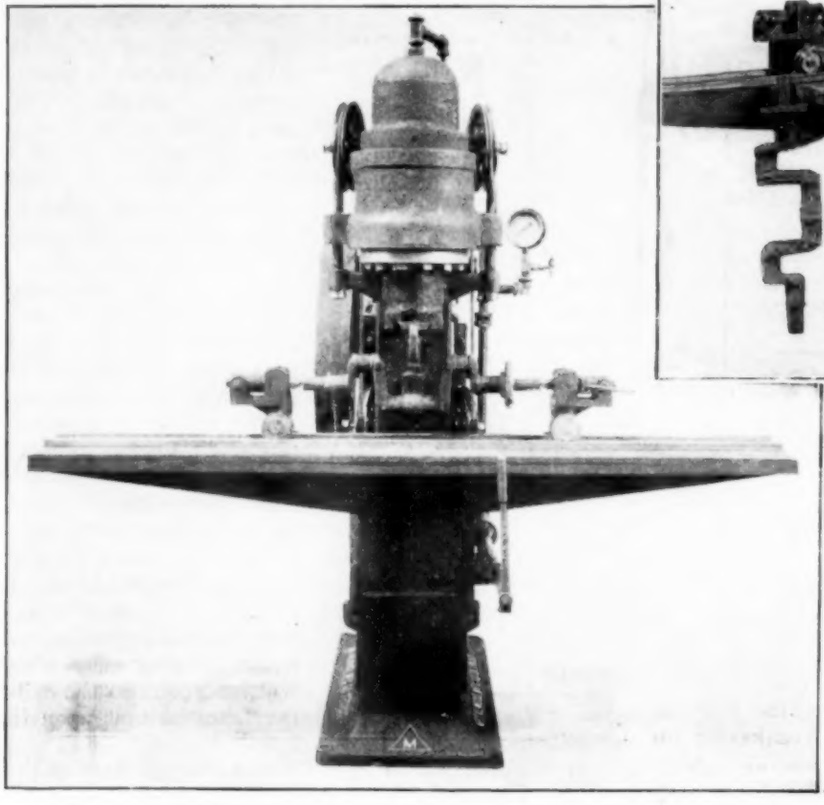


FIG. 2. STRAIGHTENING PRESS FOR USE WITH AN ACCUMULATOR SYSTEM

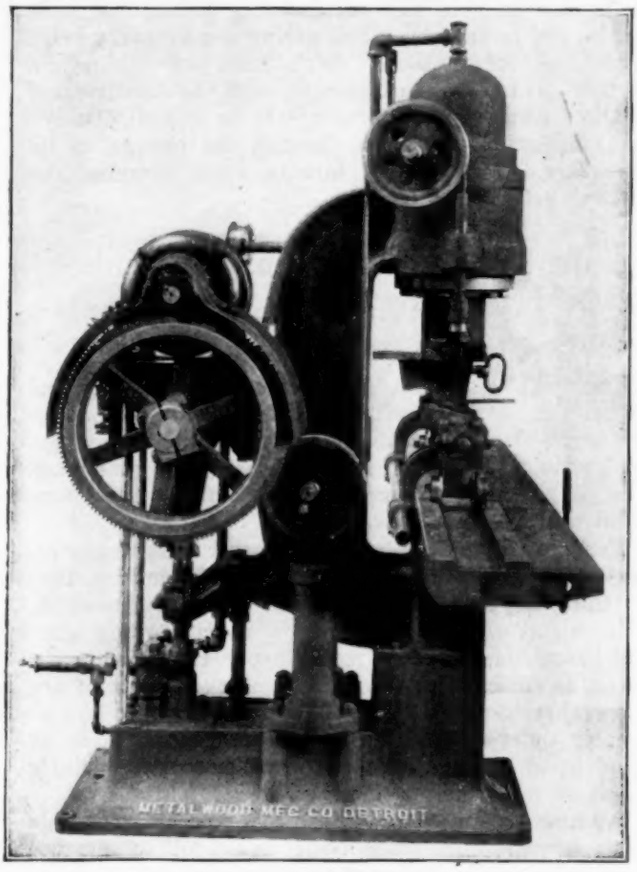


FIG. 3. SIDE VIEW OF MOTOR-DRIVEN MACHINE

The drive motor of the unit, see Fig. 3, operates through reduction gearing, an hydraulic pump, which produces the pressure necessary for actuating the ram. The oil is stored in the pump-tank in the base of the machine and the lever for controlling the valves is located in front of the table. To raise the ram and to return it automatically to its starting position after each working stroke, vanadium steel coil springs enclosed in retaining cylinders on each side of the machine are provided. These springs so act through cables and sheaves that their elongation is only half of the travel of the ram. The lower end of the ram is provided with a nose having two steps and made in the proper shape to suit the design of the shaft being straightened. This nose is dovetailed into the ram, so that it may be readily slipped forward and back by means of the small handle at the front. This permits of bringing the proper step of the nose over the shaft and under the center of the ram.

A carriage, which has centers for supporting the crankshaft, is provided on the bed of the press, and it should be noted that the shaft remains in position on the centers through all the straightening operations. The carriage can be moved longitudinally, so that the different bearings can be brought successively under the ram. The center heads of the carriage are joined in the rear by a heavy bar, on which they may be moved so as to suit different lengths of the crankshafts. This bar shows at the rear of the bed (Fig. 3), the advantage of this position being that it in no way interferes with the placing of the work in the machine.

Whenever pressure is applied to the crankshaft the centers are relieved of the load by placing wedge-shaped blocks between the shaft and the bed on each side of the ram. These blocks, which are seen in position in Fig. 4, can be placed in any position along the entire length of the shaft. When applying pressure to a portion of a shaft the outer ends beyond the wedge blocks are sprung upward as indicated in Fig. 5, thus lifting the carriage off the bed. To prevent injury to the centers in case of excessive downward pressure on them, the points are mounted in housings which can be swung downward and which are held in place by coiled compression springs. This construction, which can be seen in Fig 5, also provides ample cushioning of shocks.

Rate of Production

In practice the average number of strokes obtained from this press is 15 per min., the average length of stroke being 6 in. The maximum pressure required for the average crankshaft job is 35 tons. Actual production records vary widely with the class of work and the skill of the operator. However, it is interesting to note the statement of the manufacturer that the figures from a number of shops straightening 4-throw crankshafts show an average production per 10-hr. day of 300 shafts per man. A similar average obtained on 6-throw crankshafts gives a production of 250 shafts per 10-hr. working period.

The machine built for use in connection with a pressure accumulator system, Fig. 2, is similar in general construction and operation; but it is provided with a small hydraulic constant-pressure ram for returning the main ram to its highest position, instead of using springs. All operation is controlled by a single three-way valve.

Machine for Straightening Tractor Crankshafts

The No. 597 machine, Fig. 6, has been designed for extra heavy work, particularly for straightening heavy tractor-engine crankshafts. The center heads are carried on a sliding carriage which can be racked along a heavy bed made of a steel I-beam. The design provides for handling forged shafts up to 3-in. diameter on the main bearings and with a maximum length of 7 ft. 6 in. The brackets holding the rollers on which the carriage rests are so constructed and mounted on springs that the table comes down to a full bearing on the bed when pressure is applied on the work. The same type of wedge blocks as already described for the other machine are used between the shaft and the table for taking the thrust of the ram off the centers, which are spring cushioned, but of different design than used on the smaller machine.

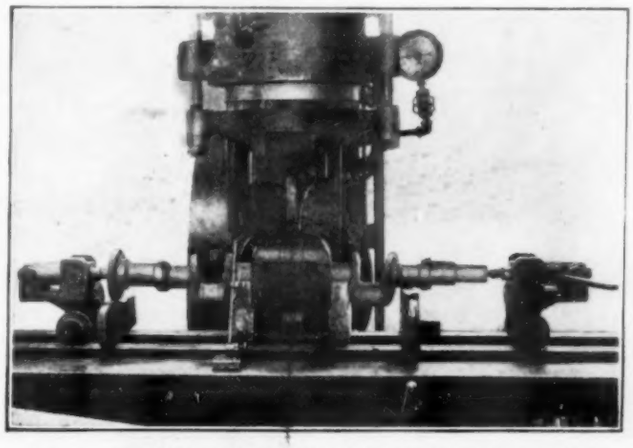


FIG. 4. METHOD OF HOLDING CRANKSHAFT DURING STRAIGHTENING OPERATION

The pressure is furnished by a two-cylinder hand-operated pump conveniently located on the front of the bed. The ram is brought down until the nose reaches the work by means of a hand-operated gear, which engages a rack attached to the ram. The movement of the ram draws oil into the cylinder from the reservoir

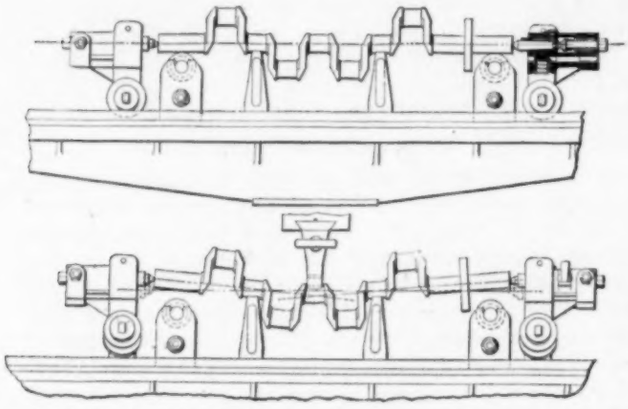


FIG. 5. ACTION OF SHAFT IN THE PRESS DURING APPLICATION OF PRESSURE

above, and after the check-valve has automatically closed, the pressure can be built up by means of the pump. The high- and the low-pressure cylinders of the pump are operated by separate hand levers. A by-pass valve operated by a treadle releases the pressure, thus allowing free movement of the liquid. The return movement of the ram is affected by means of a weight connected to a cable which passes over a sheave on the same shaft as the pinion engaging the rack on the ram.

Many forge plants give preference to hand-operated straightening presses for work where the pressure necessary to deflect the shaft is always a known factor and can be obtained by the operator by the aid of the pressure gage. The skilled workman, after determining the amount of eccentricity of the shaft by revolving it, is able to note and regulate the tonnage of each stroke, and he thereby avoids giving unnecessarily large applications of pressure. With hand-power pumps a further advantage is attained through the sensitiveness of the feeling of the operator, who is able to discover the yielding of the shaft through the change in its resistance. This enables him to avoid carrying the bending action too far.

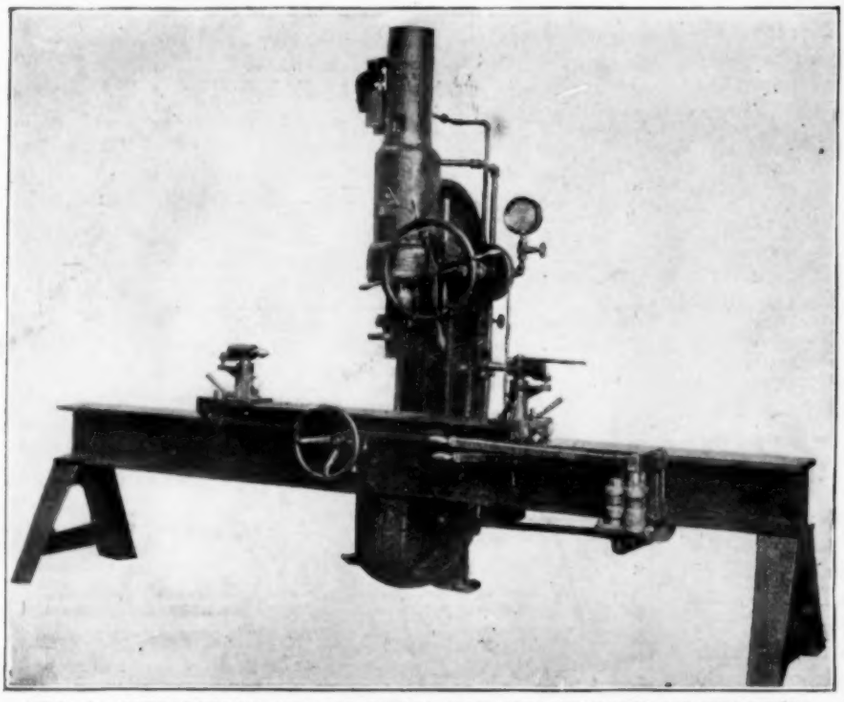


FIG. 6. METALWOOD NO. 597 PRESS FOR HEAVY DUTY ON TRACTOR-ENGINE CRANKSHAFTS

Pipe Dreams of a Tramp Machinist —How Dave Became a Baptist

BY GLENN QUHARITY

The drafting room at the Brookdell shop is a long and rather narrow room with windows on only one side—the north—and is reached by a flight of steps (or maybe I should say, a stairway) from the machine shop. The part of the building which it occupies is a comparatively recent addition to the Brookdell factory.

Perhaps the meaning that I attach to the word "recent" would be better appreciated if I admitted that anything happening since the days of my apprenticeship, about forty years ago, is recent to my grey whiskered memory. The room, though conveniently situated, is sufficiently detached from other parts of the shop, where noise is a part of the production, to be reasonably quiet and conducive to that concentration of mind in which designers and draftsmen are popularly supposed to do their work.

Walking up the length of the cool pleasant room one of these warm June mornings, it is difficult to visualize the little, dark, corner room up under the roof that was the "drafting room" of my boyhood days. This room was three long flights above the machine room, was lighted by two small cobwebby windows, and the ceiling overhead was the floor of a low, almost inaccessible, attic.

It was not ideally situated for a drawing office. One of the windows facing south and the other west, let in plenty of sunlight in the summer; especially in the afternoon. With a blazing July sun pouring down directly upon the metallic roof, it was never uncomfortably cold at this season of the year; but in December, when the sun got down behind the woods to the south, a great responsibility rested upon the one little coil of steam pipes that was supposed to keep the place warm.

The drafting room of the old days was not always, and indeed not frequently inhabited. Charlie Pratt, and later, Tom Jones, were pretty well posted in the art of drafting, and Charlie in particular, for a man who looked like a well-to-do farmer, could make a remarkably neat drawing when he chose to do so, but they were both too busy thinking up ways to keep things moving to spend much time "up attic." They were much more likely to make pencil scratches on a pad or the back of an envelope and pass them over with mysterious but meaningful gestures and fragmentary explanations to Dave.

Dave was a specimen of the genius "all round mechanic" now apparently extinct, but once plentiful. He could do stunts on lathe and planer that would make the apprentices green with envy. Although milling machines were not then what they are now he could

perform feats of wizardry upon them that would bother some of the modern "experts." He could wash his hands, take off his jumper, walk up three flights of stairs and be transformed into a pretty good all round designer and draftsman.

Dave was by no means the only one of the Brookdell force that could do these things, but he, perhaps, put in more time than anybody else in the little drawing room, and he it was that sat at the board on the afternoon of the Great Storm.

Everybody who lived in Brookdell remembers that storm; they remember how the lightning crashed in the woods; how the howling wind uprooted trees and threatened to take the roofs off the buildings, how the heavenly aqueduct busted all to smash and let the celestial water supply down on Brookdell in a lump.

Dave was not a hysterical individual. If he had a temperament he had never found it out, and he wouldn't have let it worry him if he had. Just now he didn't even know it was raining until a drop of water about the size of a marble splashed down on the drawing in front of him, narrowly missing his nose.

He glanced hastily upward and saw suspended over his head another drop that looked as big as a base ball. Without a doubt the roof was leaking. Here was something that called for instant action and he was equal to the emergency.

In a corner of the room stood a large brass shell, the first or second draw from a set of drawing dies recently completed. Dave hastily grabbed up the shell, also some screw eyes and a piece of string from the shelf, drew a sheet of heavy wrapping paper over his drawing and climbed up on the board.

Fortunately it was not a twentieth century drawing table or Dave would have met with disaster then and there. The home-made bench was strong and sturdy and from its vantage Dave had no difficulty in driving three screw eyes into the ceiling, punching three holes in the edge of the shell with an awl that had been lying on his board, and with the string he soon had the shell hung up in position to catch the drops of water as they oozed through the planking.

A temporary solution? Of course it was, but Dave had never seen *that* storm before, and upon the immediate relief from the disagreeable features he went back to his drawing and again forgot that it was raining.

Nature, however, does not forget. The drops continued to fall into the shell and they soon became a rivulet. There was a limit to the amount of water that the shell would hold, but there was also a limit, slightly lower, to the amount of weight the strings would bear.

Just as Dave was rounding out the curves of a particularly crooked cam or brushing away the last difficulty from the path of a complicated mechanical movement, one of those strings broke.

It doesn't require a college educated M. E. to discover that from a body suspended in equilibrium that shell had become a lever of the first class in which P = several gallons of water, F = the short edge of the shell bearing against the planks, and W = a darn sight more than the remaining two strings could stand.

There is no hesitancy about the working of natural laws. From the breaking of the first string to the completion of the cycle of mechanical movement there elapsed only sufficient time for Dave to turn his face upward and meet with a veritable Niagara. For the first time in his life Dave was "soused." Pens, bottles of ink, and everything else movable was swept off the

board, the drawing was ruined, and Dave himself resembled a scarecrow that had been out in the rain all night.

Though no one but Dave was present and his own later account of the incident was prosaic and uncolored as befitted a modest and self-respecting mechanic, it was understood by his friends to have been a moment of religious rite and solemn incantations.

Dave had become a Baptist.

Some Present-Day Research Problems in Electrical Engineering*

By PROF. VLADIMIR KARAPETOFF
Cornell University

While the title would indicate an electrical treatise there are no technical developments and the general nature of the subject matter renders the assertions applicable to research in all lines.

THE most natural division of unsolved problems would be according to the types of apparatus, for example, into problems in the design and operation of large turbo-alternators, improvements in lamps, circuit breakers for larger currents and higher voltages, etc. Such problems may be multiplied ad infinitum, and I should not venture to express my personal opinion upon their relative importance. For the last three years the *Electrical World* has had a research page on which anyone interested in the subject will find hundreds of opinions expressed by competent men as to the specific needs for theoretical or experimental research in practically every branch of the electrical industry. I wish to offer another and somewhat unusual classification for the pending research problems which may be more helpful to those interested only in the broader aspects of research.

Caliber of Investigator

One division of research problems that seems to me to be quite essential is based upon the caliber and mental equipment of the investigator himself. There are problems of great practical importance which can and will be solved by the expenditure of a sufficient amount of money and time. Thus, during the war the shortage of certain materials led to a large number of tests on substitutes, and in some cases satisfactory materials were found by men of average ability and education. A large number of such tests, sometimes dignified by the name of research, is being carried on all the time. For example, there are certain varieties of mica on the market, or lubricating oils offered by the principal concerns, and comparatively simple tests permit determining the kind best suited for a given purpose, without employing men of unusually high caliber.

At the other end of the scale we have researches which require men of exceptional intellectual power and of wide erudition; researches which have baffled the most persistent efforts of many years, and problems which remain unanswered in spite of the most alluring financial inducements. A reliable high-tension insulator and a simple variable speed alternating current motor may be mentioned as two such examples. In between these extremes there are innumerable gradations of mental caliber required for the solution of different kinds of research problems, and a clear realization of this fact is of utmost importance in the cultural development of the country. The tendency is to lay too much stress on material resources, equipment, and other external factors. A few men of superior caliber and thoroughly trained will accomplish results on which thousands of less gifted and not so thoroughly trained investigators may work for many years without much progress.

The necessity for better care of persons of exceptional scientific intellect is so urgent that it is legitimate to ask ourselves what our Government, leaders of industry, educational institutions, or any other agencies are doing in this direction. The answer is *next* to nothing. Moreover, in this imperfect world of ours it is no one's particular business to attend to the proper development of geniuses.

I do not have in mind a somewhat utopian scheme of breeding a race of intellectual giants by careful mating. I have in mind a perfectly feasible scheme of detecting exceptional children by suitable mental tests and then guiding them year after year to the full development of their mental powers. This is a proper function of the state and some day will become a reality.

Pure and Applied Research

Another classification of research problems is in accordance with their proximity to or remoteness from the direct industrial applications. A certain physical phenomenon, a mathematical formula, a peculiar alloy, etc., may, up to a certain time, possess no practical importance and be merely a subject of personal interest to a few investigators. Then one day someone discovers that that particular alloy or formula offers great practical possibilities and it becomes the subject of extensive industrial researches.

While such a state of affairs may seem perfectly natural and unavoidable, it has certain serious drawbacks for the best development of the art. The electrical industry owes many of its triumphs to so-called pure physical research, but until recently this industry offered mighty little encouragement to such research or to its exponents. Had the leaders of the electrical industry realized, earlier, the tremendous possibilities of physical research in improving commercial apparatus, then, instead of sneering at "doctors," they would have used their talent long ago, and we would have been much further advanced in the applications of electricity than we are now.

But it may be retorted, the scope of physics is infinite, and how can an industrial concern keep on sinking hundreds of thousands of dollars year after year on the mere possibility that some of the results of physical research may at some time prove to be of use to it. The real situation is this: Physical, chemical, or mathematical research involves first of all a method of approach, a method of attack of a certain group of related problems, based on a thorough familiarity with the resources of that particular science. Promotion of research, therefore, consists primarily in the encouragement of the study and further development of such methods and not in the acquisition of a large number of unrelated facts. A scientist trained, say, in alter-

*Address delivered before the Erie, Pa. Section of the A. I. E. E. on May 17, and the Cleveland Engineering Society on May 18, 1920.

nating currents will be prepared to approach a new problem in this field with much better chance of success than one who has had merely general practical experience and beats about the bush in an effort to discover a short cut by luck.

Thus the promotion of pure research is another national problem and the first aim must be the training in the methods of analysis, general laboratory methods, the ability to find what is already known, the use of mathematics, the use of methods borrowed from other branches of science, general accuracy of measurements, of computations, of statements, and last, though not least, that loving attitude toward nature and the intuition that comes only from a first-hand contact and observation of actual physical phenomena without any preconceived theory or utilitarian thought.

In the early development of our industry we sneered at all research, then we called plain testing research, later we grudgingly tolerated industrial research, that is, an investigation of a particular piece of apparatus in its complexity. Finally, it began to dawn upon some of us that an investigation of the very physical elements which enter into that particular piece of apparatus may lead to interesting discoveries. In this way it gradually became clear that a thorough investigation of the physical laws governing this or that branch of industry may be the quickest and the surest way toward remedying the difficulties in the operation and construction of certain pieces of apparatus. I should not be surprised if in a few years we should make a fad of pure research in industrial establishments and overdo it as we overdid safety, efficiency, patriotism and many other good things.

Experimental and Theoretical Research

The next division of research problems is into experimental, mathematical, inventive, critical, indicative of new fields, etc. A clear understanding of this division on the part of investigators themselves and of their business managers will help scientific progress materially in that it will allow each one to apply his effort, imagination, and inspiration where it will bear the best fruit and it will enable two or more investigators to combine their efforts without jealousy or duplication.

Almost any big research problem involves some theoretical study as well as experimental skill, inventive ability, and patient search for the work of other investigators and its critical analysis. Only a very few investigators possess all these accomplishments to the same degree, and it is in the hands of a harmoniously organized group of scientific workers of different talents that research leads to gratifying results.

A chain is as strong only as its weakest link. Many a research worker struggled in vain with a problem for which he was eminently fitted, just because he failed to recognize this one weak link in himself or was too proud to ask for help on some particular point of difficulty.

The Anglo-Saxon race is individualistically inclined perhaps to a greater degree than the other civilized races. The Americans among the Anglo-Saxons are especially prone to exhibit the Western pioneer spirit in research with all its virtues and shortcomings of which the utter disregard of the work of preceding investigators is perhaps the most characteristic one.

I do not mean to imply for an instant that an original thinker should be hampered in the flight of his fancy by laboratory assistants or by skilled mediocrities, in the name of a misapplied principle of co-operation. I mean two other things. First, to clear a big idea in his mind, he ought to know how to let go of it and allow his assistants to play with it for a while and see how it shapes itself in detail. Secondly, if in the preliminary molding of his ideas, he should be handicapped by his lack of mathematical ability or of foreign languages (two handicaps common in this country) let him not try to solve the problem in an imperfect manner alone without first having exhausted the possibilities of associating with other gifted and congenial minds who may furnish the missing needs of the problem.

An outsider and often a manager think that research men specialize by subject, so that one knows all about direct-current machines, another all about transformers, etc. While to some extent this is true, yet there is a much more thorough-going and desirable specialization according to the nature of the man's talent. One is especially gifted in arranging ingenious methods for accurately measuring difficult quantities, whether it be in a.c. or d.c. machinery, another can skilfully present a phenomenon or a relationship in a mathematical form, a third is particularly adept in finding out quickly and accurately all the preceding contributions on the subject and in assigning the proper relative value or trustworthiness to each.

Possibilities of Co-operation

The possibilities of co-operation in research on the part of persons of different temperament and ability go far beyond the confines of one industrial organization or even one country. International co-operation in research is just as important in view of the favorable and unfavorable racial idiosyncracies. Anyone who follows European scientific magazines cannot fail to notice these racial distinctions in the treatment of distinctions in the treatment of identical subjects.

A student of the history of science can easily recall cases in which a scientific idea is born in one country and then is taken up by someone in another country and finally brought to a fruitful development in a third country.

Perhaps the best-known example in our line is that of Hertz, a German, who acted as an intermediary between Maxwell, an Englishman and Marconi, an Italian. A biologist could easily get examples of living organisms which have to live under different conditions at the various stages of their development. Thus the rust of wheat must live on barberry before it can live on wheat. We in this country, with its polyglot population, have had an exceptional opportunity to observe and to benefit by this co-operation right in our midst, even though in our Anglo-Saxon arrogance we are apt to look down upon our brothers from across the seas. There is hardly an organized institution for research in this country that cannot point to benefits derived from associates of foreign birth and training and point of view.

In conclusion I wish to point out that while first-class original investigators are born and not made yet there is a great problem before our leaders in politics, industry, and education, to facilitate the work of such men by granting favorable conditions for their creative activity. We ought to do this for our sake and for that of the coming generations. It is in the hope of contributing to the clear understanding of the conditions

that promote the welfare of research workers that the preceding remarks are made.

(During the address Professor Karapetoff gave examples of electrical research done or suggested by various prominent investigators. These illustrations were mostly from the items published on the Research Page of the *Electrical World*.)

Trade Papers

BY E. F. CREAGER

[HOW I READ MINE AND HOW I FILE THE INFORMATION FOR REFERENCE.]

Being away from home I purchased at a news stand a copy of a trade paper that I am a subscriber for. The salesman said, "Heluva lot of advertising in that there magazine. It will take you a long time to dig down to something interesting." He, like many readers, just viewed the advertising pages as an extra. I do not feel that I have done full justice to myself if I do not carefully scan the advertising section for something new. With pencil in hand I glance through the index of reading matter and find several articles of interest to check up. One appears exceptionally interesting since I have been preparing an article on that particular subject so I read and mark it for my files and feel that I have my money's worth from this one article. Another article shows how one plant makes something similar to our product and I compare and criticize but see no reason for changing our methods. We get more pieces at a lower cost for tooling up, produce faster from a less expensive and simpler machine tool and do at one operation what requires two in theirs. Of course I feel elated and will grab my notes when I get home and clear up some points that seem vague and give the other fellow a chance to see if he is as well pleased after reading my article. (Of course you all try to give back something from your own experience in exchange for what you get from the other fellow, don't you? If not, why not? 'Tis only fair). Here is an article on a common every day tool and its life. I mark it up and will prove it out later by trial.

Here is another on metals which I read with interest and mark for filing. Now here is a punch and die and that "wrinkle" on it is just what we want and I'll bet "Jack" will be pleased when I show it to him. The Ideas and Sketches by Practical Men are always interesting, and usually yield something for the files.

The description of new tools is gone over, and I am well satisfied with my purchase. Got more this time than usual, but never fail to get something. Now I read the advertisments and begin to cull the book. These advertisements are to me the most up to date catalog I can get. Each advertiser is trying to impress the reader with the advantages and economies of his machine and unconsciously calling attention to the weaknesses of others. This machine has good points in design that I will suggest to our designer. That one shows a new idea in tooling up.

Here is a fixture, first time I ever saw it illustrated, I will write for description and prices. Another advertiser tells of the output he is getting and as the piece is similar to one we are making, and I am either "chesty" if we are getting more or depressed if we are getting less.

Here is an advertisement which answers a question asked by one of our engineers just yesterday, and as a result the advertiser will get another order. So on through the book, I mark those I desire to save and these are torn from the book and are readily filed in my vertical filing cabinet scrap-book.

I use a standard steel filing cabinet that will take a full size letter sheet and make my folders shown in the illustration from a sheet of gray fiber "Fish Paper" 12 in. x 24 in. From this I make a folder 12 in. wide, 9½ in. deep with a 5-in. flap. This will just take a page of the regular trade journal and the flap prevents it from flying open and gives a splendid place to mark the title or contents.

I find this an ideal way to file the various leaflets and pamphlets describing various articles which are ordinarily so hard to locate in the usual catalog file. In this way I get all my notes and data indexed with the minimum of effort, and have an up to date general

THE LOOSE-LEAF FOLDERS

catalog of information on subjects appealing to me. I have purchased many machines first brought to my attention in this way and frequently have been able to sell the "powers that be" when in doubt, by having the data and illustrations at hand.

At the present time, I have over two hundred subjects and folders in use, many of them cross indexed, and I can assure you that they are in frequent use by myself, my tool designers and the purchasing department and have earned many dollars for the firm. I consider them the most valuable section of my rather comprehensive mechanical library. I can pull out the folder on the subject I desire and have before me practically all the live articles on that particular item. A suggestion from this one and another from that one and a few more added and I have data for a new and original (?) machine which sometimes works as anticipated.

I may say in closing that a few former contributors to the *American Machinist* are conspicuous by their absence. Prof. John Sweet with his common sense articles and Chordal whose letters will be sadly missed by many, especially the old timers.

Accurate Lapping

By L. J. VORHEES
Industrial Engineer

Accurate lapping is an art practiced by tool and gage makers. Very few machinists of the present-day school know much about it. The author of this article gives detailed instructions for gage lapping as well as for making the laps.

IN THE larger and better equipped toolrooms there is usually at least one man experienced in lapping so that this work is handled in a satisfactory manner. But in the average, and larger majority of shops each toolmaker does his own lapping, and this, in many cases, is far from satisfactory. Many times work is either sent out of the shop on account of the trouble experienced in lapping, or an inferior grade of work is tolerated.

It is not the purpose of this article to start a controversy on the subject of lapping, or to infer that any method in use at the present time is not all right in every respect. What I desire is to explain a method of lapping in detail and with such clearness that any toolmaker, by following it, can produce gages that no shop need be ashamed of.

As plug gages under one inch in diameter are the most common, they will be taken as an example, and the method by which they are lapped can be applied to most other forms. As this class of work does not require the accuracy which is sought by aging the steel after it is hardened, this will not be considered. Whether the gages are made of tool steel and hardened, or of machinery steel and casehardened, will not affect the operation of lapping, so we will assume that the gages have been turned and hardened. If they are boiled in water for several minutes after they are hardened it will tend to remove the strain and lessen the danger of their cracking.

The centers should be carefully lapped, or ground out, making sure that all scale is removed and that they are left round and smooth so as to fit the centers on the grinding machine. A wet grinding machine is better than a dry for this purpose. A fairly fine, free cutting wheel should be used, its cutting face should be trued with a diamond, and the width of the face reduced until it will pass off the portion of the gage that is being ground at each end of the stroke of the grinding machine table, or wheel, whichever moves. The machine must be adjusted until it grinds straight, that is, grinds the plug the same size at each end, *and this should be as accurate as you can measure.*

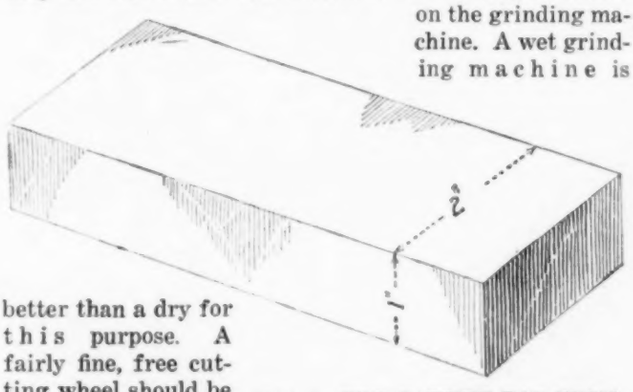


FIG. 1. THE BABBITT BAR FROM WHICH LAPS ARE CUT

Leave no inaccuracy to be removed or corrected by lapping. The lapping should remove the marks left by the grinding wheel and no more. If the grinding is properly done two ten-thousandths of an inch is enough for this. If you leave more it will require elbow grease to remove it. If you cannot remove the wheel marks in two ten-thousandths, improve the quality of the grinding until you can. Let the wheel travel over and over the plug in removing the last one or two ten-thousandths with a feed so slight that it throws sparks not more than an inch long. Do not hurry this part of the work as care taken to produce a round, finely ground gage, with just ten-thousandths left for lapping, will save time later on. With the gage in this condition you should do the lapping in a few minutes.

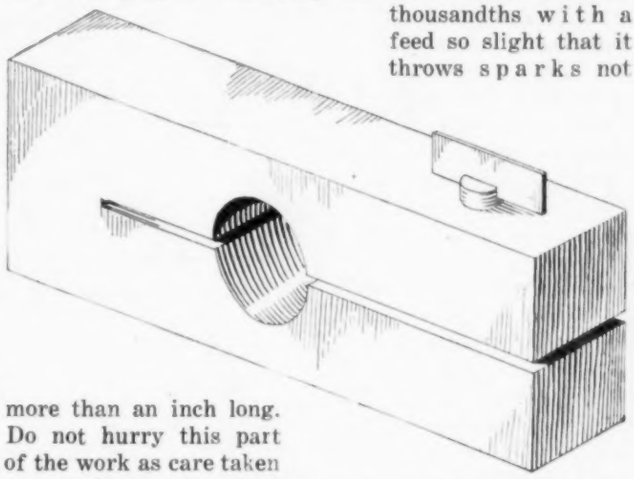


FIG. 2. A COMPLETED LAP

Use Babbitt for Laps

Use common babbitt metal for the lap. For plug gages a half inch in diameter, or under, it is convenient to use a bar about one by two inches so that the lap blanks can be sawed off from this end as in Fig. 1. The lap blank should be sawed off so it will be about as thick as the diameter of the plug, but this never need be less than one-quarter of an inch for any plug, no matter how small the diameter.

Drill a hole through the center of the blank the size, or slightly smaller, than the diameter of the plug to be lapped. Start a saw cut in the center of one end, parallel to the drilled hole, and saw down through the drilled hole and out half way to the opposite end. This will permit the hole to be closed around the plug. In the end in which the saw cut was started, about half way between the hole and the end of the lap and at right angles to the hole, drill through with a drill that is the tap size for a No. 10 machine screw, for instance. Enlarge the hole from one edge down to the saw slot with a drill that is the body size for a No. 10 machine screw, and tap the other side with a No. 10 tap. By screwing a No. 10 screw in this hole from the side that is not tapped it will tend to draw the sides together, which later will close the lap around the plug. For convenience a piece of flat stock may be soldered

in the slot of the screw so it can be tightened with the fingers. Fig. 2 shows a lap ready to use.

Assuming that you have turned the handle and body of the plug in one piece, place the handle of the plug in a spring collet of a bench lathe, preferably, and leave a space between the body of the plug and the spring collet equal to half the diameter of the plug. Loosen the screw in the lap and open it until it will slide over the plug easily. Place it over the body of the plug. Remove the center from the tailstock and move it up until there is the same space between the plug and the tailstock as there is between the plug and the collet.

Secure a shallow dish that will set on the bed of the lathe and is large enough to catch the oil and abrasive that drops from the plug and lap. *Do not use abrasive flour, or powder. Do not think that the finer the abrasive, the finer the finish.* Grains, or size, *160* to *190* are about right. Mix a small quantity with common light machine oil, using enough oil to cover the abrasive well. Adjust the lathe belt until the lathe runs quite slow, not more than two or three hundred r.p.m. and stop the lathe while you charge the lap. This is done by working a layer of oil and carborundum in between the plug and the lap, the lap being opened until it is very loose on the plug, and then tightening the lap on the plug by means of the screw. The abrasive that is between the plug and the lap will be *imbedded in the lap.* If the abrasive is too fine, or the lap too hard this imbedding cannot take place. Fig. 3 shows the way the lap is used.

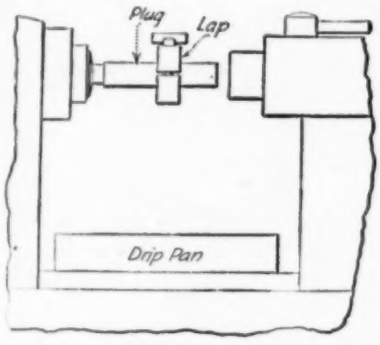


FIG. 3. PROPER POSITION OF WORK FOR LAPPING

Now to start the lathe, stand close to the tailstock, reach over the lathe with one hand so you can hold one end of the lap in each hand. As you push on the lap gently it will travel from one end of the plug to the other. The collet preventing it from slipping off at one end and the tailstock at the other, though they allow about *half of the lap to project over each end of the plug,* before it is stopped by butting against them. As you are now sure there is no danger of the lap slipping off the plug, try to hurry it, that is, make it travel faster from one end of the plug to the other. As you use more pressure you will reach a point where the lap seems to let loose and slides rapidly the length of the plug until stopped by the collet or tailstock. *This is the action of the lap you should maintain at all times.*

Run Work Slowly—Move Lap Fast

One of the chief points of good cylindrical lapping is to *run your lathe slowly and move your lap fast.* Jerk it rapidly from one end of the gage to the other. When the slight scratches on the plug, produced by the lap, cross the plug at an angle of about 45 deg. you will know that the speed of your lathe and lap is about right. With this method of lapping it will not be necessary to leave a projection on the plug to be removed after it is lapped in order to prevent the end from being rounded off. This method gives you ends that are full size and square. Keep plenty of oil on the lap and when it seems to have stopped cutting charge it again the same as you did the first time.

Never add fresh abrasive or try to charge the lap until you have stopped the lathe and opened the lap until it is loose on the plug. Pry the lap open with your screwdriver until it is ½ of an inch larger than the plug.

Keep a dish of gasoline that is about room temperature near the lathe and each time before you measure the gage dip it in the gasoline, and leave it until it has cooled to the temperature of the gasoline and room. As it gets nearer the finished size take more pains with this cooling.

Do not freshly charge the lap to finish the gage. Arrange to do the last lapping, and finishing, with a dull lap. When the gage is lapped almost to size, wash both it and the lap in gasoline, put on a little oil, and finish the lapping with oil only; this will give a smooth finish. If you want to still further improve the looks of the gage, after it is lapped to size, wash it and the lap in gasoline until they are free from oil and put the gage back in the lathe and start lapping while still wet with gasoline. Watch the gage as you lap and you will see it dry off leaving a slight film which the lap will pick up, when dry enough. Keep on lapping after this film is picked up and you will produce a high polish almost entirely free from scratches. This description sounds long but when you become familiar with it you will lap a gage in just a few minutes.

To lap a ring gage prepare a lap of babbitt metal as described in almost any treatise on lapping, charge it with abrasive that is not too fine, revolve the lap slowly but move the work over it with a rapid reciprocating motion, in other words, grasp the work in both hands and jerk it from one end of the lap to the other rapidly. I want to emphasize this fact strongly because it is usually the custom to revolve the work rapidly, as where a plug is held in a chuck, and to move the lap back and forth slowly.

Dry Lap for Flat Surfaces

In lapping flat surfaces run a lap of babbitt on a backing of cast iron. Any convenient metal may be used in place of the cast iron as its purpose is merely to stiffen the lap. Plane the surface of the lap as smooth as possible. Sprinkle abrasive over the surface *and rub it in* with a piece of hardened steel, which may be ground flat and smooth and kept for the purpose. Don't use too much abrasive, as a little will rub into the lap, and charge it, better than a larger quantity. After rubbing over the surface of the lap twice, using short strokes and considerable pressure, brush off all free abrasive and carefully rub the work to be lapped over this surface. It is not necessary to use oil on a flat lap, in fact, I believe it works better dry.

Now here is a point to be remembered by the inspector as well as the workman. Everyone familiar with lapping knows that a soft spot in the gage will pick up the abrasive used in lapping and leave a dark, dirty looking, spot. A visual inspection for hardness is all the gages usually receive, as it is assumed that if they were not properly hardened that these black spots would surely show. But such is not the case.

After a man has carefully made a gage and during the process of lapping finds there is a soft spot in it, he dislikes to throw it away. Therefore he will try to save it, if he possibly can, which means that he will try to cover up, or remove, the spot so it will not be

noticed. He can do this too; as a little careful rubbing with a piece of crocus cloth will remove the imbedded abrasive and make this black spot look just like the remainder of the gage so that a visual inspection will not disclose it.

Therefore when you inspect a hardened and lapped gage go over the surface carefully with a very hard, sharp pointed, instrument. Do not use pressure enough to scratch the hardened surface of the gage. You can easily tell the soft spots by the way the instrument cuts into the surface, and drags, instead of slipping easily.

Regardless of the means employed to determine the size of the gage you will find that this method, if followed carefully, will give all the accuracy and finish required.

High-Speed-Steel Tools for Turning Tires

BY FRANK A. STANLEY

The practice of the Southern Pacific shops at Sacramento in respect to the making of high-speed formed tools for turning tires is represented by the illustrations herewith.

The solid or one-piece formed tire tool of high-speed steel has of course been long out of the question, leaving as an alternative the built-up tool with a section of high-speed steel secured to the body of carbon steel. At the shops noted the cutting-tool proper is forged to approximate outline of the contour required and very little material has theretofore to be removed to shape the tool to exact form.

In Fig. 1 a high-speed-steel cutting tool forged closely to shape is shown in the lower left-hand corner of the group. Directly over this or in the upper left-hand corner is a carbon-steel block which is milled out to form the holder or base for the high-speed tool. The appearance of the holder after it has been cut out for the welding in of the cutting tool is seen at the right, and in the lower right-hand corner is the finished tool ready for service.

A group of tools with the high-speed portions welded on is shown in Fig. 2, this illustration showing the tools before any machining cuts have been taken in finishing the working surfaces of cutting-edge proper.

The sketch in Fig. 3 shows the manner in which the holder is cut away in step fashion to provide liberal

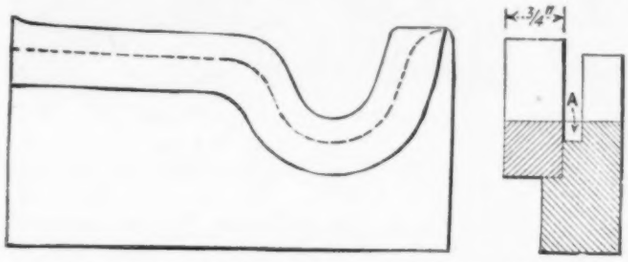
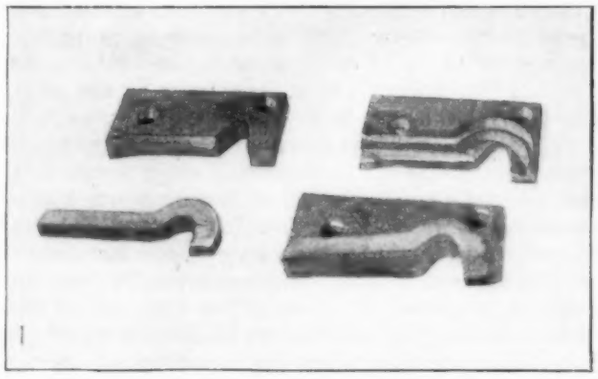
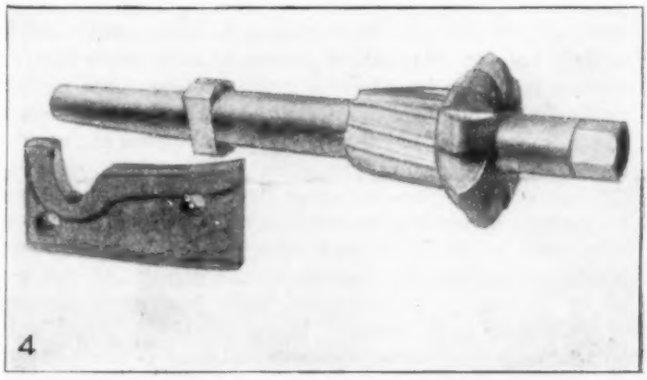
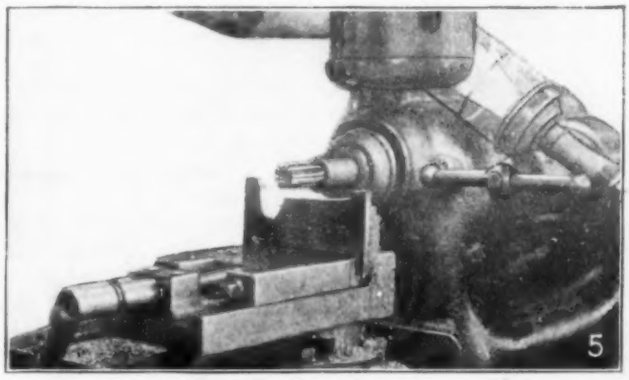


FIG. 3. HIGH-SPEED-STEEL TOOL AND BLOCK

space at *A* for the flowing in of the welding steel under the action of the acetylene torch or the electric arc. The high-speed tool itself is made a little over ¾ in. thick in the rough so that it will face down to ¾ in. in grinding. It is afterward used down to a thickness of ¾ in. so that the life of the tool is over an extended period. The holder or base block is cut out to the form of the high-speed section and milled away at the front to give ample clearance behind the cutting edge. These tools are made in lots of a half dozen or more and the work is facilitated by the use of special cutters in the milling machine.







FIGS. 1, 2, 4, 5. THE TOOLS AND HOW THEY ARE MADE

Fig. 1—Tire tool before and after welding. Fig. 2—Group of right- and left-hand tools ready for finishing. Fig. 4—Cutters for milling the tool edge. Fig. 5—Milling the tool block.

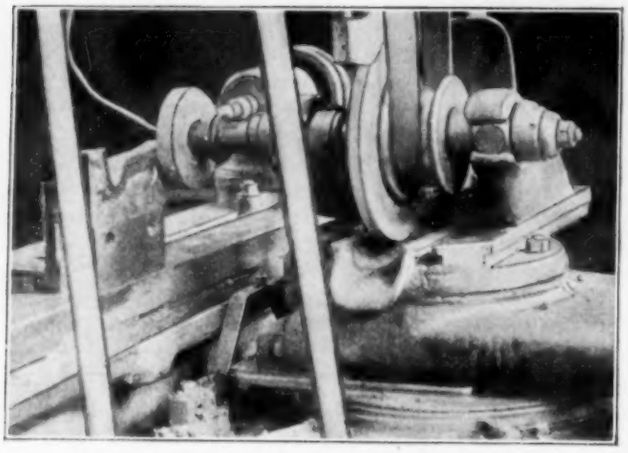


FIG. 6. GRINDING THE FACE OF THE TOOL

Fig. 4 shows the pair of milling cutters for forming the high-speed cutting edges. The deep cut in the tool for finish-forming the flange on the tire is milled out by the large cutter; the cutter at its side on the arbor is a spiral mill ground to proper shape to form the portion for machining tread of the tire.

In Fig. 5 the milling machine is shown set up for milling the edge of the tool block to form the clearance under the lower edge of the high-speed-steel section and to provide the seat for the high-speed section itself. The section through the tool and block in Fig. 3 shows the shape of the work at this point.

The method of grinding the top face of the tool in preparing it for service and for resharpening it as it becomes worn in operation is illustrated by Fig. 6. An angle plate is secured to the reciprocating table of the grinding machine and the toolholder is fastened to the upright of the angle plate by two bolts tapped in from the front. The work is then passed to and fro across the face of the cup wheel.

The cutting edge of the tool is finished in the milling process to a front clearance or rake of 7½ deg. The top face is ground out with a convex wheel to give a clean lip and provide a free cutting action along the broad face.

Why Work?

BY ENTROPY

In these piping times of peace when everyone is thinking of everything except his duty, and when foremen dare not fire a workman for fear of starting a strike that will cost a great sum of money, the question is in many men's minds, "Why work?" Many are answering the question by not working any more than they can help, with the result that time hangs heavy on their hands, the eight-hour day seems longer than the ten-hour day ever did and the ascending spiral of cost of living mounts faster and faster.

But what are the incentives to work hard? Each man as a unit produces so little than it seems hardly worth while to make the effort. Individual effort brings neither additional money nor thanks, but only the disfavor of other workmen.

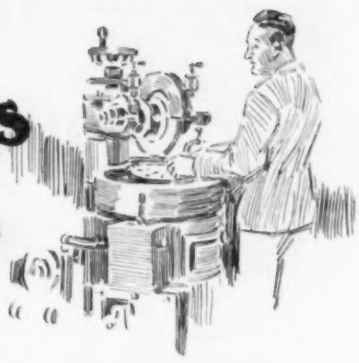
The only man who works in the real sense of the word today is the far sighted chap who can imagine the time when he wants a job and when a lot of other people want the same job. He is the man who understands that at present we are only kept in a stable position by spinning around like a top, and that when we begin to whirl only ever so little more slowly we are bound to tumble. It may be that we will tumble slowly, but it never has happened that way before, and it is very doubtful if it can happen otherwise than it has happened before. When the crash comes, and shops have to let men go, they always retain what they call their "organization" if it is a possible thing. By this they mean that essential minimum of men who are profitable and whose morale, instilled into the green men whom they will pick up when the tide turns, will build a harmonious force. This does not necessarily mean that they keep their most capable men, but the most dependable ones. It means the men who will work without watching, and who work intelligently always. It means the men who believe in the firm, even to the point where they will risk losing their reputations to back it outwardly, and will risk their jobs in criticising it mercilessly inside the shop, for the sake of bettering it. These men are perfectly well known to the management at all times. There is no need for a long notice of impending shortage of business to name the men who will be kept employed so long as the ship stays afloat. They are the men who work for the company's interest all the time.

Just how good an investment is it for a man to do twice the work now that is necessary to hold the job? No one knows precisely but we know that for a long time back we have run on cycles of about ten or twelve years of which less than half have been spent in real prosperity and nearly all the rest of the time spent in climbing painfully out of the slough into which we have been precipitated almost over night. The fair weather man has had good wages less than half of the time since the Civil War, and he has had starvation wages the rest of it. He has had practically half wages for the past fifty years. The man who has stuck to the ship and done his work through thick and thin has had just as good wages during good times, and in proportion to the cost of living he has had more than good wages the rest of the time. He is at least twice as well off.

Exception to this rule is the fault of the organization, and we have to admit that there are many faulty organizations. Petty internal jealousies, lack of breadth of vision, and fear are the principal factors which hinder the complete reward of the faithful worker. Internal jealousies on the part of a foreman who does not want it known that a certain man is truly capable for fear that he will be promoted out from under him and he will have to break in another man to fill the place; on the part of fellow workmen who are resentful of the apparent favors which are shown men who are in favor and who deserve all that they get and usually much more. Lack of breadth of vision is a factor which is always to be reckoned with and absolute fear on the part of the employer is another thing which may warp his judgment, but on the whole, our employers are pretty level headed, especially regarding their own business. Of the two, more failures occur from too great optimism, too early a hope for a recovery of business than from too much pessimism. The jealousies of foremen and other workmen, are merely hazards of the process of getting ahead and must be reckoned with just as a farmer reckons with hail storms.

All-in-all it is really worth while to work, even though the returns for the moment may not seem to be increased by so doing.

Applying Magnetic Chucks to Best Advantage



by I. A. Hunt
Of the Heald Machine Co.

NEARLY every mechanic will tell you that he knows what a magnet is, but experience with magnetic chucks indicates that only a very few know its physical properties, with the exception of its ability to attract iron.

This is quite natural, for but few mechanics have the good fortune to be well posted in electricity. For this reason they are inclined to apply the magnetic chuck to only the simple jobs. This not only applies to war-made mechanics but to some of the old-time foremen, superintendents, and even proprietors of proved ability. Therefore a simple explanation of the physical properties of a magnetic chuck may help in getting the best results and in extending uses to work which may be thought impractical to hold in this quick and efficient manner.

The magnetic chuck has grown to be an indispensable tool in practically every machine shop, great and small, and while such chucks are very simple in construction and easily understood as to principle, there still seems to surround them an element of mystery that acts to prevent many machinists and toolmakers from using them to best advantage. The appended article from the pen of a man intimately associated with the manufacture of magnetic chucks should serve to sweep away some of the mental cobwebs and make clear to everybody the possibilities and limitations of this tool.

The magnetic chuck utilizes the same power that turns an electric motor. A magnetic chuck is simply a single electromagnet, like Fig. 1, or a group of them, arranged so that their ends or poles will make contact with the work and so hold it firmly in position by its pulling power. In order to really understand how to secure the best results from this peculiar holding power a bit of the theory of magnetism will be helpful, but this will be better appreciated if reference is made to the misuses of the magnetic chuck.

Some operators do not realize that the more closely the work makes contact with the chuck the more firmly it is held. Another weak point is the fact that they do not know that every magnet has two poles, a positive and a negative, and that the pulling power travels from one pole to the other. Consequently, it is necessary that the work make contact with both poles to secure the greatest holding power.

The same principle is lost sight of when an operator tries to place parallels under the work, thinking that the magnetism will enter it and hold it. The trouble is that the magnetism finds an easy path through the parallels to travel from pole to pole and does not enter the work. Special parallels may be used that are designed to conduct the magnetism to the work and that will not cause it to find a shorter path through themselves as will be explained later.

Theory explains magnetism by assuming every particle or molecule of iron as being a magnet itself. Normally, these particles or molecules are located helter skelter with no particular relative position, as shown in Fig. 2. An electric current flowing continuously in the same direction has magnetic power which will turn these molecules all to the same relative position as in Fig. 3, and their influence, combined with that of the electric current, results in the magnetic holding power of the electromagnet. This holding power is referred to as "magnetic lines of force," and should be thought of as such in considering how to place work on a magnetic chuck, for it is by an understanding of their action that the best results are obtained. Magnetic lines of force travel easiest through soft steel and are resisted to certain degrees by cast iron, hard steel, and various compositions of iron. Air has a resistance 100,000,000 times as great as that of iron which readily explains why work must make pretty close contact with a magnetic chuck in order to be held firmly. Non-magnetic material, such as brass, lead, wood, etc., does not conduct magnetic lines of force. This explains the use of the non-magnetic metal surrounding the inserted polepieces that are readily distinguished in any magnetic chuck. If these poles were not insulated in this manner, the lines of force would escape from pole to pole and, thus finding a short path, would not enter the work.

Various Types of Chucks

There are, of course, several types of magnetic chucks and the foregoing principles apply to all of them. There are valuable points to be considered in selecting a chuck and these will be noted at the end of this article. All magnetic chucks, however, have either two magnetic poles, a positive and a negative, or a series of alternate positive and negative poles. This is necessary as the magnetic lines of force travel from the positive to the negative pole. This circuit is obstructed by the resistance of the air unless an iron path is made for them to travel in, as is the case when the work is placed on the chuck. Consequently, it is quite necessary that the work reach from pole to pole in order to be held

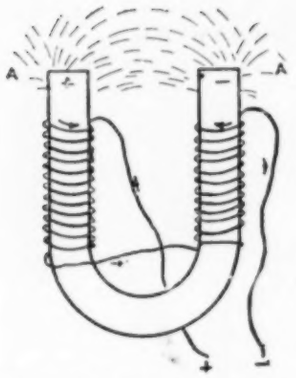


FIG. 1. A SIMPLE ELECTRO-MAGNET

FIG. 2

FIG. 3

FIGS. 2 AND 3. ILLUSTRATION OF THE MOLECULAR THEORY OF MAGNETISM

firmly. If it is not large enough to do this the circuit may be completed by placing the pieces so that they touch each other, thus bridging the space between the poles.

Fig. 4 shows a common form of magnetic chuck with the top plate and a part of the body in section to show the way in which the magnetic lines of force travel. Here you will notice they pass up through the polepieces and through the work, also less readily through the air. From the foregoing it will be appreciated that a rough casting which allows plenty of air space between its surface and the poles of the chuck will not be held as firmly as would be the case if the surface was first snagged off to reduce the high spots, thus bringing the iron closer to the poles.

As only so many magnetic lines of force can enter a given area of iron, it follows that a piece of work covering three or four square inches of chuck surface will be held down stronger than a piece covering only one square inch. This not only applies to the width and breadth but to the thickness as well, because very thin stock does not allow enough lines of force to pass through to get a grip. This drawback can be remedied by laying a thicker piece of stock over one end of the work to be ground—increasing the path for the lines of force with corresponding increase in holding power.

Holding Irregular Shapes

Fig. 5 shows the way in which work presenting an irregular surface may be held on a magnetic chuck. An extra top plate, a duplicate of the standard top plate on the chuck, may be machined to fit the shape of the work and then screwed to the top of the chuck as shown. Of course, the chuck itself may be machined, but this spoils the chuck for other work and is apt to open up the joints in the top plate.

In Fig. 6 is shown a method tried by many mechanics

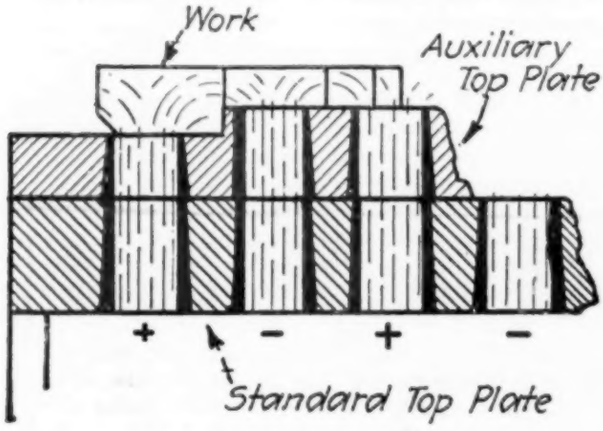


FIG. 5. AN AUXILIARY TOP PLATE

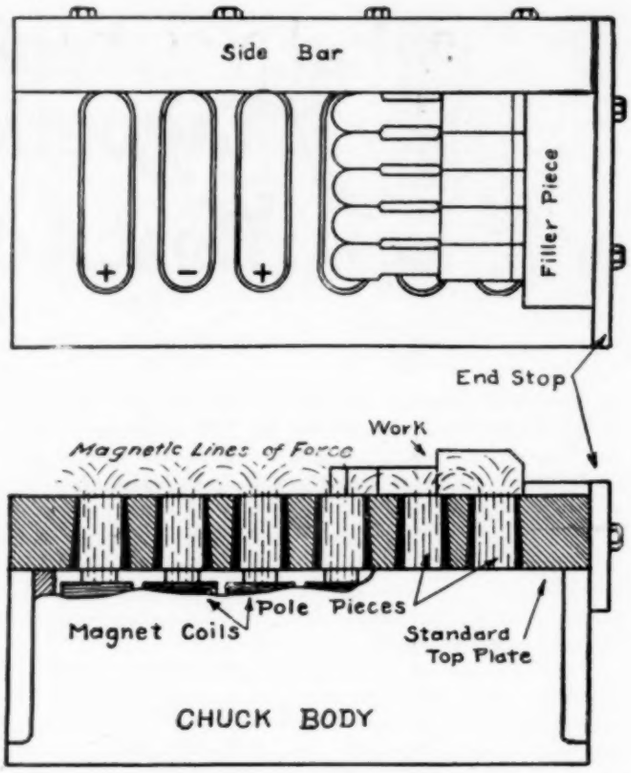


FIG. 4. SHOWING DIRECTION OF TRAVEL OF LINES OF FORCE

that is unsuccessful because the magnetic lines of force enter the solid iron plate and do not enter the work. This is practically the same thing as trying to use ordinary parallels on a chuck. It is absolutely necessary that the poles of the chuck be insulated from each other right up to the surface of the work, otherwise the lines of force will take the shorter path.

All magnetic chucks can be divided practically into two classes. The oldest type embodies the principle of a single magnet; the later types use a series of electro-magnets placed side by side, or, in the case of a rotary chuck, they are placed radially.

The Single-Coil Chuck

Fig. 8 shows, roughly, the principle of the original types. Notice that a single coil is used. One pole of the magnet leads directly to the top of the chuck; the other pole or end of the magnet coil is led around through the body of the chuck to the top.

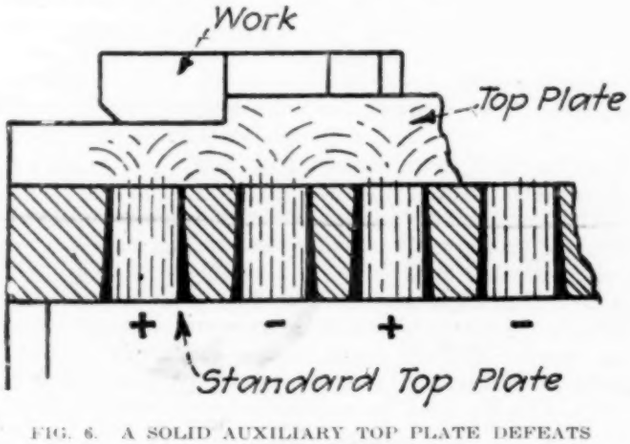


FIG. 6. A SOLID AUXILIARY TOP PLATE DEFEATS ITS PURPOSE

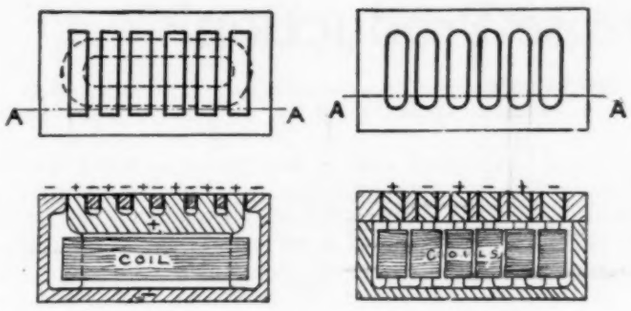


FIG. 7. THE ORIGINAL FORM OF CHUCK WITH SINGLE COIL

FIG. 8. THE MULTIPLE COIL CHUCK

This type of chuck is simpler to make but embodies two drawbacks. One is the fact that the roundabout path just referred to required for the magnetic lines of force to reach the top plate, dissipates them, resulting in a weakened chuck. Moreover, once the chuck is magnetized it is less easily demagnetized. The other objection is that the lines of force, in traveling this roundabout circuit, leak off into the table of the machine, and in time magnetize the table and the cutters or tools.

Multiple Magnets

The later types of chuck are as shown in Fig. 9. The number of poles is determined by the size of the chuck. Here you will notice the poles alternate positive and negative and lead directly to the top of the chuck. The magnetic coils are arranged so as to alternate, causing the bottom and body of the chuck to be neutral as is the case at the round end of the ordinary electromagnet shown in Fig. 1. The chuck is more readily demagnetized because the body and the top plate frame are neutral, the poles and cores only being magnetized.

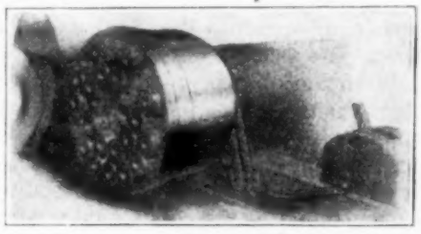


FIG. 9. APPLICATION OF RETAINING RINGS

Any chuck should, of course, be water-tight and rigidly built Some are stronger than others and it is a good idea to buy a rectangular chuck with end and side stops, for though these may not be required for grinding purposes they are very necessary when milling or planing, and as you never know when the chuck will be transferred from a grinding to a milling machine it is well to be prepared In the case of rotary chucks, retaining rings can be used, as in Fig. 10, to take care of excessive thrusts of the grinding wheel or tool.

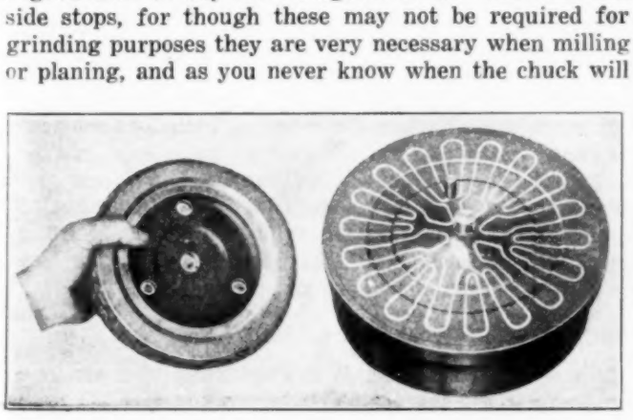


FIG. 10. ROTARY CHUCK WITH CENTER AND DRIVING PINS

Magnetic chucks have been successfully used to a limited extent on lathes where the work is of such a nature that driving pins or lugs could be arranged to drive the work, the chuck serving to hold it in place. A chuck arranged for use on the lathe is shown in Fig. 11.

Demagnetizers

A word about demagnetizers may be of value to many who are not sure, when buying a chuck for the first time, whether or not a demagnetizer is required. All chucks are furnished with demagnetizing switches which demagnetize the chucks and allow the work to be removed from it. If the work is of soft steel or cast iron and is to be used in a place where a slight amount of residual magnetism will not interfere, then no demagnetizer is required. But hardened steel and very hard cast iron retains magnetism, and in such work as dies, cutters, pawls, etc., where the magnetism would be a source of trouble, it can be removed by means of a demagnetizer.

The Oldest Form of Demagnetizer

The oldest form of demagnetizer is really a single magnet through which alternating current instead of direct current flows. The rapid reversals of polarity shake the molecules out of position and cause the work to be demagnetized when slid (not placed) across the extremities of the magnet. The later type is a hollow coil of wire through which alternating current flows, the work simply being inserted in the coil for an instant. This type is especially adapted to irregular shaped work and is very efficient.

Whenever trying out new work on a magnetic chuck be sure to recall every principle of the magnetic lines of force and how they act and you will be able to handle much more work in this efficient manner than the man who merely lays the work on the chuck in any old way and then condemns the chuck if it doesn't hold. A magnetic chuck will not hold everything, but like any machine, the more you know about it the more service you can get out of it.

Iron Castings In Iron Molds

By Elliot A. Kebler
President, Fawcus Machine Co.

Replying to the inquiry of A. W. Forbes on page 1311, vol. 52 of *American Machinist*, it is true that castings can be made in iron molds without chilling, and in fact there is a patent on such a process, which consists of removing the iron mold and also the iron core very quickly from the casting. If this is done within, say, three or four seconds, the iron is not chilled and in fact is malleableized and is, therefore, stronger than if cast in a sand mold.

A drawback about the process is that the iron molds bust be very thick, weighing two hundred pounds or more for each pound of the resultant casting.

The reason in my opinion why a permanent iron mold cannot be used is that each time the mold or the core is used it becomes slightly larger so that each casting made will be larger than the previous one.

How Can We Increase Production?*

By SIDNEY J. WILLIAMS
Secretary and Chief Engineer, National Safety Council

PRODUCTION depends primarily on two factors—machines and men. Production also requires materials, but these in turn are produced by other machines and men—using "machines" broadly to include all equipment. Production also requires capital to provide the machines and the men, and management to direct them. But machines and men are the immediate producers. They and they only can increase or decrease production. The things that cause them to do the one or the other are the things that we must study.

The basis of modern production, with respect to both machines and men, is regularity—standardization. The Swiss watchmaker a hundred years ago built his watch from the ground up, fitting each part to the parts already completed, as a carpenter builds a house. He never made two watches exactly alike. I believe the Swiss watchmaker still follows somewhat the same method. But we in America make our dollar watches (which now sell for two dollars) and our two dollar alarm clocks (which now sell for four) with dies and jigs and fixtures; we stamp out the parts on power presses or machine them in automatic screw machines, so that part No. 106 always fits part No. 105 exactly, although the men who make the two parts may never have seen each other and may not speak the same language. Whether in the eyes of an artist all the alarm clocks in America are worth a single beautiful Swiss watch, is a question that I will leave to philosophers. We as a nation are committed to the principle of mass production; and while we may deplore the vanishing of the old crafstman, few will suggest a return to the former order.

The Motion Study Expert

But we do not stop with standardizing machine operations. We standardize also the operations of men. The motion study expert tells us that practically every man wastes a large percentage of his time and effort in even the simplest operation—that a dozen skilled mechanics will do the same thing in a dozen different ways, all of them wrong. So the motion study expert determines the one best way to do a job, and in one case after another we find that by following his method we not only increase production but we decrease fatigue. While so-called "efficiency engineering," like other pioneer movements, has suffered from the pretensions of quacks, there can be no serious question that modern industry demands the elimination of lost motion and the standardization, so far as is practicable, of every job in the plant.

If this is true, as it is true, I do not believe that any one will question the next proposition that I want to make—that anything which interferes with this absolute regularity of operation is inefficient and uneconomical, and that it is one of the chief functions of the engineer and the executive to hunt out these disturbing influences and eliminate them.

The things which thus interfere with regular production are many and varied. Some of them are external to the plant itself—such as a war, or a nation-wide strike, or a railroad tie-up. The prevention of these is largely a function of government, and the American people will not long tolerate conditions that permit such national inefficiencies.

Then there are catastrophies within the plant: a strike; a disabling fire; a break-down in the power plant. Every one knows that it is the function of management to prevent such occurences and that a management which does not in general prevent them cannot be permanently successful.

Then there is a third group of apparently minor disturbances: A laborer pushing a truck strikes an uneven place in the floor and a casting falls off the top of the load. The casting is heavy and he goes for help to put it on again. Meanwhile the lathe operator is waiting for the casting. The blockade of the passageway stops another truck coming up with material for another operator, who must also wait. The total loss of time may not be more than four minutes for each of five men—twenty minutes in all, or, say, twenty-five cents worth of time.

What does the foreman do when he finds that the lathe operator is waiting for material? If he is a foreman of the old school, he goes back and bawls out the "blankety blank wop" for running his truck into a hole in the floor. The man, thus admonished, is henceforth more careful—that is, he is slower in his movements. He takes pains to avoid holes in the floor, the posts in dark passageways, the other various sundry obstructions which sprinkle his pathway. A little later the foreman is surprised and grieved to find that he must put on another man to help the truckers because they cannot keep up. He discourses feelingly and eloquently with the assistant superintendent on the total depravity of laborers in general and of his laborers in particular. Am I exaggerating? Not very much. How many of *us* carefully walk around a hole in the floor, or a slippery place, ten times a day, because it would take a little mental and physical energy to fix it up?

Of course, the foreman who is really onto his job has the floor fixed at once. If he is unusually intelligent, he also looks around for other things which interfere with efficient trucking. He may find that the lighting in the passageway is poor, and recommend to the superintendent that it be improved. He may find that the truck itself can be slightly changed to as to make it less likely that anything will fall off. The up-to-date foreman realizes that when his laborers each lose twenty-five cents worth of time a day it is up to him, not to bawl them out for it, but to find out what is wrong and correct it. And it is up to the superintendent and higher executive officers to supply what the foreman lacks in this regard. Once labor was the cheapest part of the cost—but the dollar-a-day man is gone.

The Value of Little Things

In machine operations it is even more obvious that regularity is the essence of modern production. I dare say that every punch press foreman or superintendent in the United States has as his idea of heaven a place

*Address before Engineering Section, National Safety Council, Chicago, June 24, 1920.

where—if puch presses are tolerated at all—not one of them ever misses a single stroke. Unfortunately this kind of heaven is seldom met with on earth.

I know of large and successful companies where punch press production is from 25 to 50 per cent less than perfect—that is, where only half or three-quarters of the strokes are productive, simply because proper means are not provided for placing the material in the press and taking it out again. The important point is that the greater part of this loss is positively preventable through the use of simple and inexpensive automatic or semi-automatic devices for placing and removing the material. The fact is that, with comparatively few exceptions, even in the most efficient plants, we have not had time to study these little things—the castings falling off the truck, the material sticking to the punch press—causing in each individual case a loss of time reckoned only in seconds or minutes, but causing in the aggregate a loss running undoubtedly into many millions of hours and many millions of dollars.

Leaks Must be Stopped

In the past, so vast were our resources that we could overlook these small losses, just as the city of Chicago pumps millions of gallons of water that are wasted through leaky pipes. But now the time has come, with our diminishing man power, diminishing natural resources, and prospective sharp competition from abroad, when we must meter and stop these leaks if we are to maintain our volume of production and our economic place in the front rank of the nations. I have tried thus far to make the point that modern production is built absolutely on standardized regularity of operation and that anything that interferes with regularity interferes with production. It is putting the same thought into other words to say that it is our constant effort to find the one best way of doing things and then always to do them in that way; and that anything which happens unexpectedly, whether it is a coal strike or a casting falling off the truck, is bound to interfere with our regular program and therefore to cut down our production. Therefore, it is interesting to observe that the Standard Dictionary under the word "accident" gives as its first definition this: "Anything happening unexpectedly." In a second definition the dictionary recognizes, of course, the common usage of the word "accident" as meaning an occurrence in which some one is hurt. But in the broader meaning it is plain that, from the standpoint of industry, a coal strike is unexpected and is therefore an accident; a breakdown of the power plant is unexpected and is therefore an accident; the sticking of material in a punch press is unexpected—not contemplated or desired by the designer of the machine—and is therefore an accident, whether any one happens to be injured or not. In short, "accident" in the broad meaning given it by the dictionary is exactly synonymous with all the disturbing things which interfere with production—it is the exact opposite of production efficiency. It stands precisely for all those things which we as engineers and executives must fight unceasingly.

Safety and Production

Now I come at last to the point where safety enters into the proposition. Some of the "accidents" which I have mentioned—some of the things which happen unexpectedly—result in personal injury. From the standpoint of the man interested only in production, the accidents which happen to injure some one are no more and no less important than those which do not. It is true that from other standpoints the accidents causing personal injury are much more important. To the legal department, they mean the payment of compensation. To the employment department, they mean the necessity of providing another man. To any man with a spark of human feeling in his heart they mean pain and suffering to a fellow human being, perhaps poverty and distress to his dependents. But leaving these considerations out of account, considering ourselves as absolutely non-human engineers or executives, with an abundant supply of skilled labor and no compensation laws to worry about, even then we must recognize that at the very least the accident which injures some one is no less important than the accident which does not injure any one, and all these accidents—all these things happening unexpectedly—interfere with the regularity of our operation, and cut down our production. No engineer or executive living can afford to say, "I am not interested in accident prevention," unless he is willing to say, "I am not interested in efficiency," because accidents and efficiency are absolutely incompatible; they cannot exist in the same plant. Every accident is an indication that there is something wrong with men, methods, equipment, or material.

Executives Must Be Interested in All Accidents

And if the engineer or executive must then be interested in all accidents, whether they cause injury or not, those which do cause injury have for him a peculiar importance, because they stand out conspicuously and serve as danger signals to warn him of the inefficiency that is undermining his output. This is not theory but fact. The improvements in punch press operation, which I have already mentioned, were suggested and carried out—by whom? By the production department or by some imported efficiency engineer? No—by the safety man! He found that men were losing fingers in these punch presses because they had to reach in to the press to place or remove material. He changed the method of operation by introducing automatic or semi-automatic feeds and kickouts. He did this primarily to prevent the loss of fingers. Having done it, he found that he had increased production from 25 to 100 per cent. The foremen were astonished. They need not have been astonished. Reflection would have shown them that the movement of the operator in reaching into the press, while it occasionally caused the loss of a finger, always caused the loss of time; and that an arrangement which would save the occasional finger would also save a fraction of a second every time the machine was operated. To quote another instance of a more general nature, the manager of one of the largest paper mills included in the membership of the National Safety Council once said to me, "Before we had a safety committee, every little while we would have to shut down our machine because of a belt breaking or something of that sort. Now our safety inspection catches these things before they happen and we have no more shut-downs.

Our safety work has more than paid for itself through the increase in production, aside from cutting down our compensation costs."

You may say, "These plants were not run efficiently. If they had been, it wouldn't have taken a safety man to show them how to feed punch presses or keep belts in

repair." I freely grant this. Yet the fact remains that both of the plants which I have mentioned were and are in the very front rank of their industries. they were well managed, they were making money. The management simply, like every other management that I know of, was so busy with development and with the outstanding problems which it had to face that it could not watch every single detail.

A Striking Instance of Safety Efficiency

In another instance, even more noteworthy than those I have mentioned, the chief engineer of a large company conceived an entirely new method of accomplishing an important process in the industry—a method wholly mechanical, to replace one which required constant attention by skilled men. It happened that these men were exposed to injurious dust. When the new plan was presented, it was opposed by some of the experienced factory executives who declared on general principles their firm conviction that it would not work. The president of the company said: "Even if the new method does not increase production as we hope it will, it will at least remove this danger to the health of our men. Therefore we will try it out." It was tried out. It worked. It cut down the number of attendants required from 23 to 3 and removed all hazards to those that remained. It increased production so tremendously that it will undoubtedly revolutionize the entire industry. This two-fold result was not a coincidence. It was a natural result of the fact that the old process was wasteful in both materials and time. The injurious dust that should have gone through the manufacturing process was blown out into the faces of the men. The new method saved both the dust and the men.

The man who did this remarkable piece of work was not a "safety engineer." He was an engineer who believed in safety. As a man, he believed in safety as a human necessity. As an engineer, he believed in safety as a thing inseparably bound up with engineering efficiency.

The Human Value of Safety

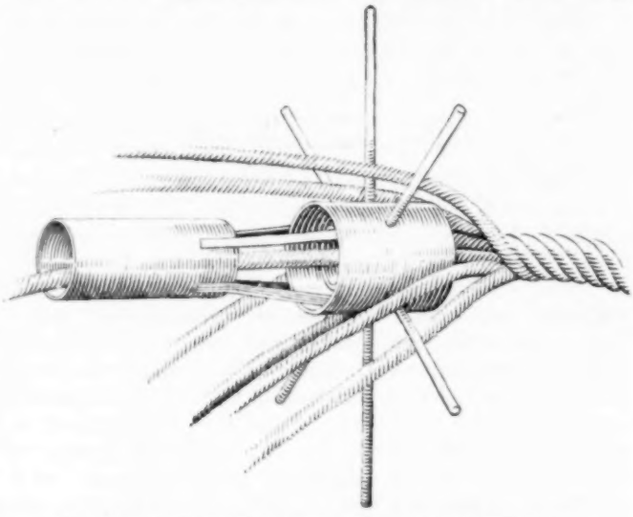
On the human value of safety, I leave each of you to judge for yourself. I know how I feel and I think I know how you feel, but that is not my topic tonight. On safety as an engineering job—I know that the engineer whom I have mentioned, and the safety man in the punch press shop, and the paper mill manager, are right—I know that safety and engineering efficiency are inseparable. You cannot have one without the other. If you safety men think you have to put on a guard that interferes with production, you may be sure that your remedy is only a temporary one and that it must give way eventually to an improved machine or method which will be safe without being inefficient. And the engineer or executive who thinks that accident prevention is not in his department—that he will leave that to the safety man or the insurance company or the state inspector—is missing something—something big. He will find out some day that every accident in his plant or on the machine which he designed is a danger signal for him—a symptom of time and dollars wasted as well as lives and limbs. The rough-shod methods of American industry a generation ago, which left a trail of human wreckage, were not only inhuman—they were inefficient. They, and the men who stood for them, have gone on the industrial scrap heap, and none of them will ever return.

Salvaging the Inner Strand of a Worn Cable

Special Correspondence

At the plant of the Spanish-American Iron Co., in Cuba, a 3-in. steel cable had been condemned and discarded because the outer strands were worn and frayed. The 1½-in. inner strand was in good condition and, as the cable was a mile and a quarter long, it seemed advisable to salvage it. The problem was to cut away the six worn strands and leave the inner strand intact. This was accomplished with the device illustrated herewith in conjunction with an oxy-acetylene torch.

Six pieces of pipe were ox-welded into the rim of a small pulley. A short piece of sheet-iron pipe was fastened to the pulley and in line with it, by welding



DEVICE FOR SALVAGING THE INNER STRAND

on four iron straps. The outer strands of the cable were unwound for a few feet so that the inner strand could be passed through both the bore of the pulley and the pipe. With the outer strands placed between the six spokes in the pulley, it was only necessary to revolve the device against the lay of the cable and advance it as the strands were unwound, the inner strand being allowed to lie in a continuous length along the course of the work. When the strands unwound reached an unwieldy length (about 6 ft.) they were cut off by a portable ox-weld outfit.

The cable, of course, remained stationary, the inner strand being coiled up and the scrap collected after the work was completed.

The device and the method used are due to an American mechanic, John Crawford, who was in charge of the work.

Sweeping Back the Tide

By Otto Vogetzer

. The second paragraph of the article, "Sweeping Back the Tide," on page 33 of the *American Machinist*, is very interesting, to say the least.

There is an opportunity for Mr. Forbes to earn the everlasting gratitude of the community at large by letting us in on the secret of how and where unskilled labor may be hired at wages from $15 per week DOWN. Is this a misprint or was it written in 1910?

Connecting Rods for the Fordson Tractor

By FRED H. COLVIN
Editor, *American Machinist*

Here is a distinctly novel method of holding and locating connecting rods during the various machining operations. It is an application of the three-point suspension method to manufacturing, and is well worth considering as a positive method of locating work in various operations.

THE transformation sheet, Fig. 1, shows the principal machining operations, the numbers corresponding to the figure numbers of the illustrations in this article. These rods, which are for the Fordson tractor 4 x 5-in. cylinder, clamp the piston pin to the rod, and use a babbitt bearing cast into the rod. The piston pin is 1⅜ in. in diameter, the crankpin 2 in. and the center distance 9½ in., the length of the main bearing being approximately 2¼ in. These sturdy proportions indicate the kind of work a tractor motor is called upon to perform.

The rods are first heat-treated and tumbled and the ends ground and faced. Then comes the straightening on the bench shown in Fig. 2. The bench itself is of cast iron and carries the straightening block shown, the block having hardened-steel faces *A* and *B*. The

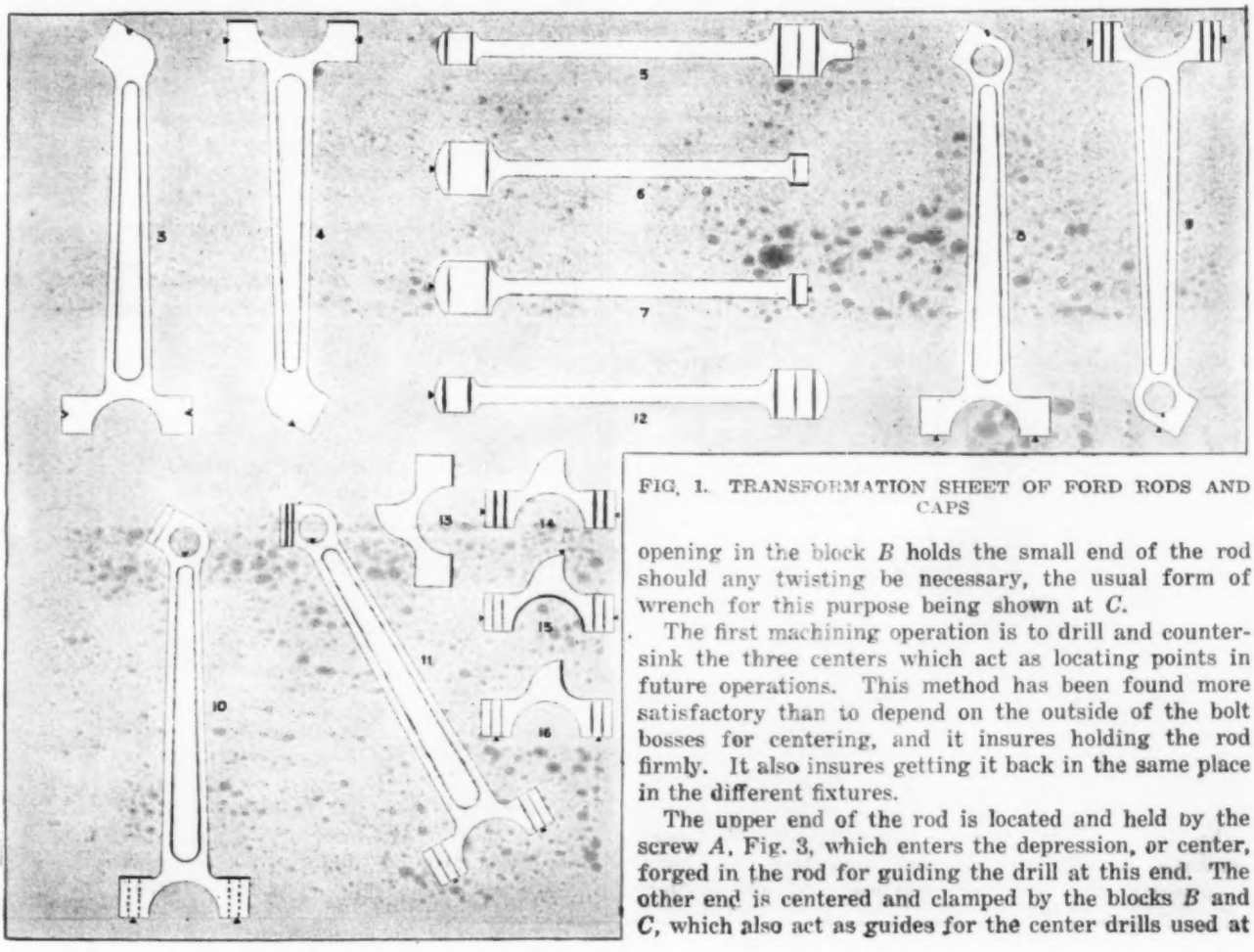


FIG. 1. TRANSFORMATION SHEET OF FORD RODS AND CAPS

opening in the block *B* holds the small end of the rod should any twisting be necessary, the usual form of wrench for this purpose being shown at *C*.

The first machining operation is to drill and countersink the three centers which act as locating points in future operations. This method has been found more satisfactory than to depend on the outside of the bolt bosses for centering, and it insures holding the rod firmly. It also insures getting it back in the same place in the different fixtures.

The upper end of the rod is located and held by the screw *A*, Fig. 3, which enters the depression, or center, forged in the rod for guiding the drill at this end. The other end is centered and clamped by the blocks *B* and *C*, which also act as guides for the center drills used at

AUTOMOTIVE CONSTRUCTION

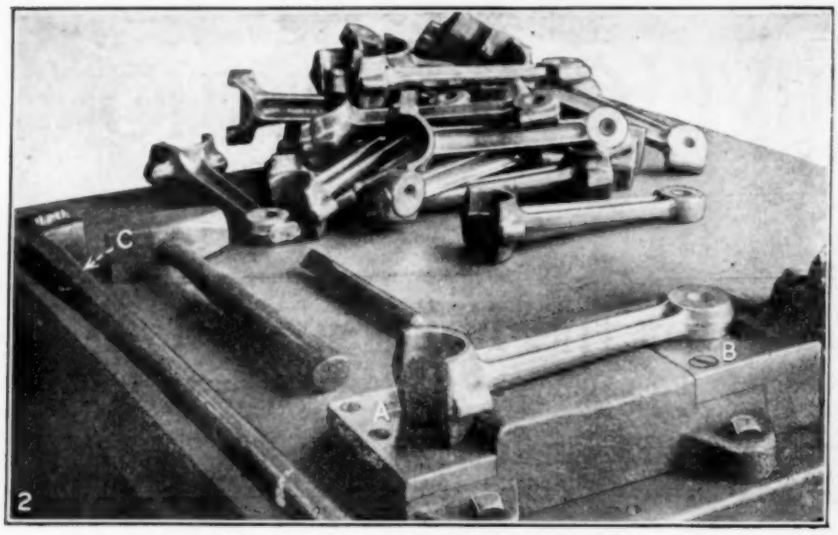


FIG. 2. THE STRAIGHTENING BENCH

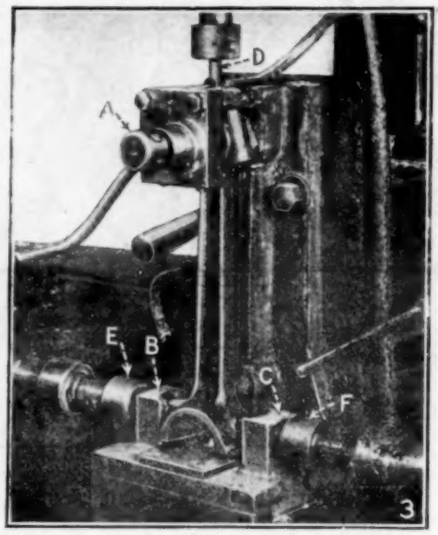


FIG. 3. DRILLING LOCATING CENTERS

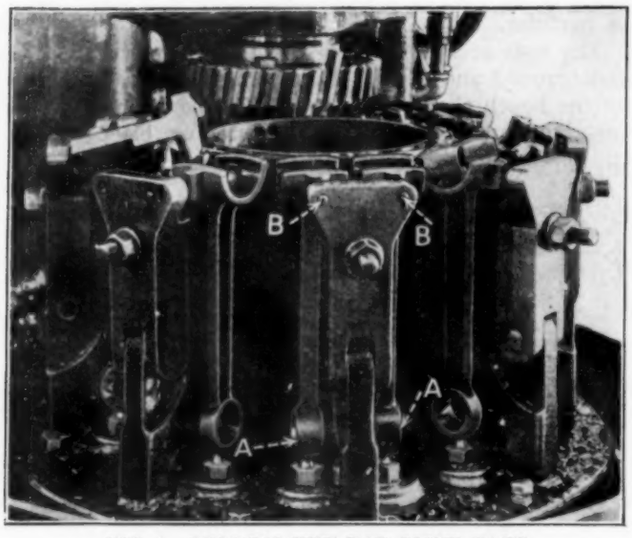


FIG. 4. MILLING THE ROD-JOINT FACE

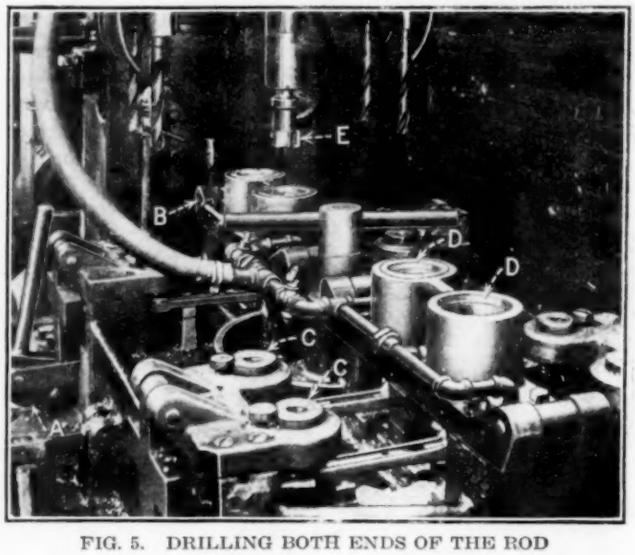


FIG. 5. DRILLING BOTH ENDS OF THE ROD

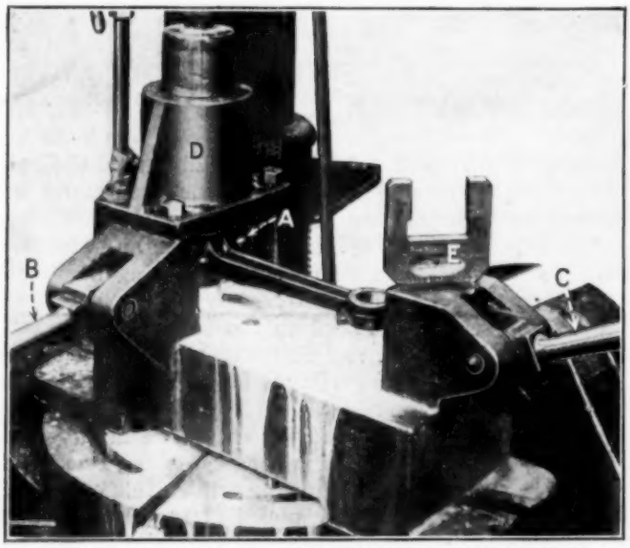


FIG. 6. FACING THE SIDES OF THE ROD

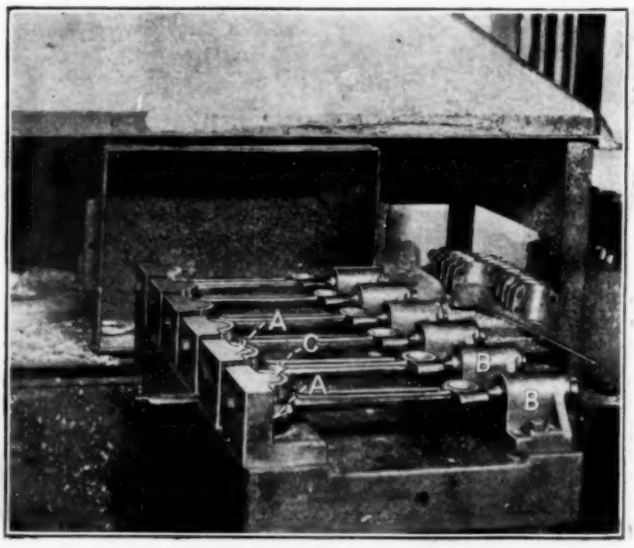


FIG. 7. BABBITTING THE ROD

AUTOMOTIVE CONSTRUCTION

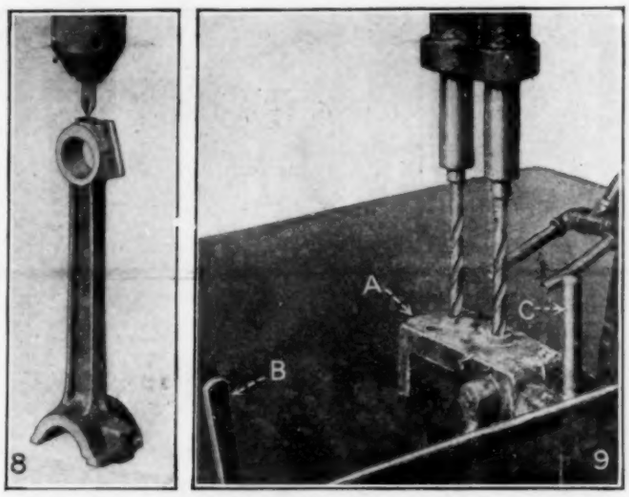


FIG. 8. RE-CENTERING THE SMALL END. FIG. 9. DRILLING THE BOLT HOLES

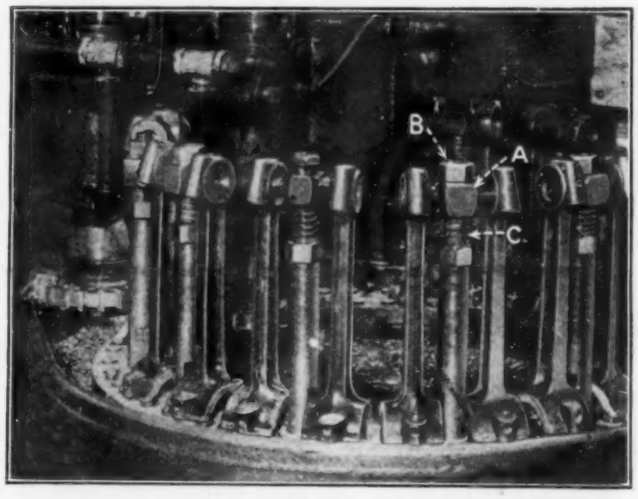


FIG. 10. MILLING THE UPPER ENDS OF THE BOLT BOSSES

this end. The three combined center drills and countersinks at *D*, *E* and *F* then drill the three locating points, which are to be used in future operations. The centers in the bolt bosses are drilled nearly at the top so as to avoid all tendency of closing in the ends under the pressure of the clamping centers.

The first use of these centers is in milling the joint face in the continuous milling fixture shown in Fig. 4. Each station holds two rods, the small ends being located at *AA*, while the upper ends are held in position by the centers *BB*. The holding clamps are easily operated, as can be seen, and the rods are loaded and unloaded while the table keeps continuously in operation.

Unusual Rod-Boring Method

The boring of the rods is somewhat unusual, the large ends of two rods being butted together as shown in No. 5 of transformation sheet, Fig. 1, and as can be inferred from the construction of the fixtures in Fig. 5. The rods are again located by the three centers, these being controlled by cams, two of which are shown at *A* and *B*. Two of the drill bushings for the small ends are shown at *CC*, while two of the large bushings are at *DD*. The latter guide the boring tool *E*, which bores the ends of the two rods which have been so located by their holding points as to make this possible. This is an indexing fixture so that one end can be loaded while the tools are at work on the other.

Next comes the facing of the large ends in the fixture shown in Fig. 6. The center *A* is stationary, but the other two centers are forced into position by the handles *B* and *C*. The facing cutter has a substantial guide at *D*, and the gage *E* shows when the bearing has been faced to the proper length.

After reaming the small ends the rods are then washed in hot soda and are ready for babbitting. They are first properly tinned and then placed in the fixture shown in Fig. 7, the rods being held squarely against the plates *AA* by means of the centers *BB*. Each plate carries a half-round form or mandrel as at *C*, and the babbitt is poured in place by means of the ladle shown. The caps

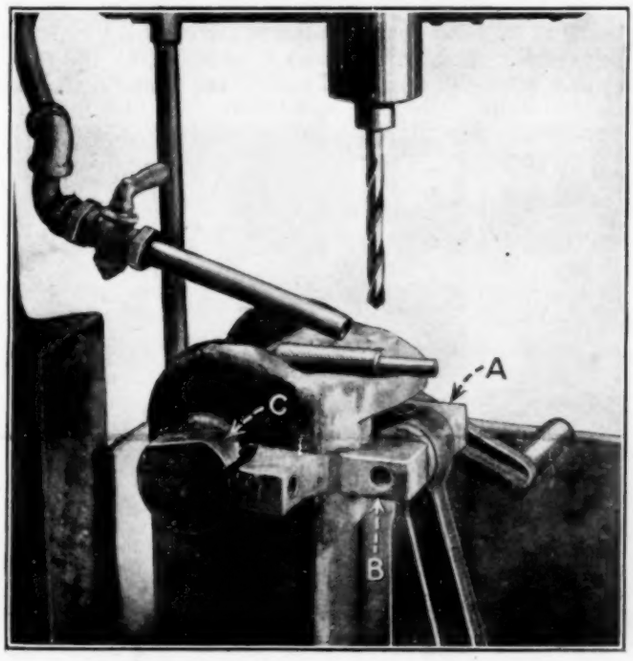


FIG. 11. DRILLING CLAMPING-SCREW HOLE

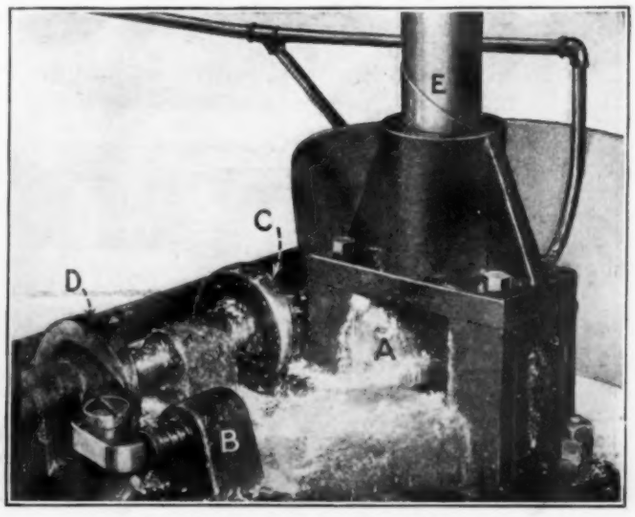


FIG. 12. REAMING ROD AND CAP

AUTOMOTIVE CONSTRUCTION

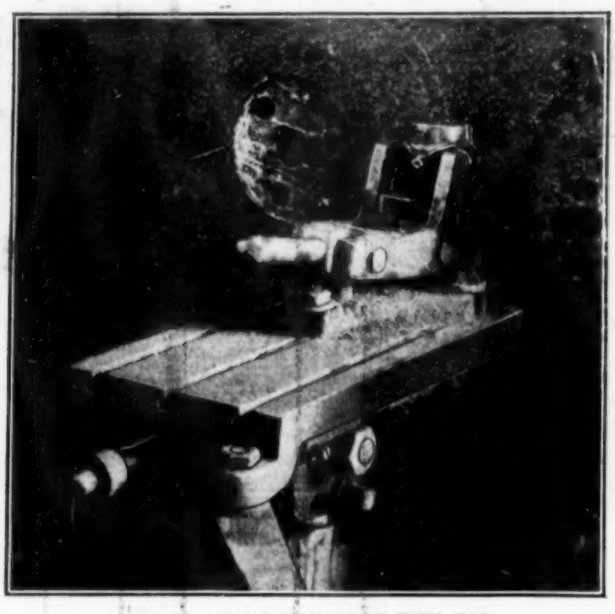


FIG. 13. DISK GRINDING THE CAP

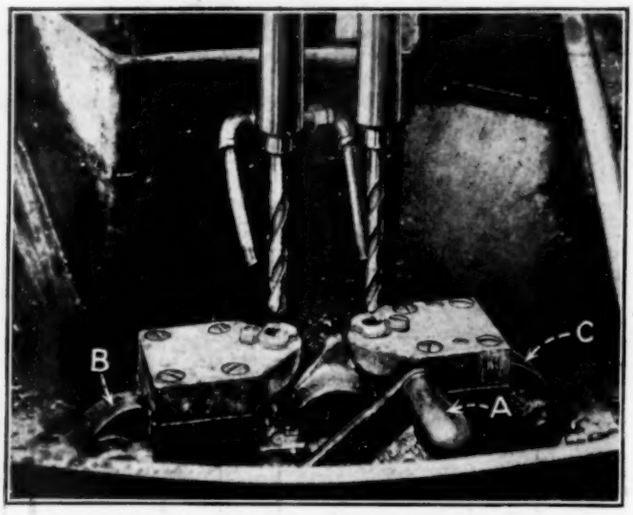


FIG. 14. DRILLING THE BOLT HOLE

are babbitted in the same manner. As can be seen, this fixture is located adjoining the babbitting furnace. The fact that this outfit handles 1,300 rods in 8 hr. indicates the ease with which it can be operated. The surplus babbitt is dressed off with a rotary file, after which the upper center is refinished, as shown in Fig. 8.

Drilling and Facing Bolt Bosses

Bolt holes are next drilled with the two-spindle drilling head shown in Fig. 9. The rod is held in the fixture *A*, the handle *B* controlling the lower center and the handle *C* the clamping center on the side. It will be noted that the whole fixture is surrounded by a high metal tank, which allows flooded lubrication without danger of splashing over. One drilling machine handles 334 rods in an 8-hr. day.

The upper ends of the bolt bosses, known as the bolt clearance in this shop, are milled in the double-spindle continuous milling machine shown in Fig. 10, which can handle 2,200 rods in 8 hr. This operation is practically identical with that of the Ford Motor Co. The three locating points are not used in this operation. Instead, the bolt holes are located over suitable dowels, while the piston-pin ends are carried on the double crosshead *A*, the rods being forced down onto the dowels by the nut *B*. The spring *C* beneath the crosshead raises the rods away from the dowels as soon as the nut *B* is released.

The fixture for drilling the clamping-screw hole is also similar to the Ford Motor shop method, the rod being clamped by the arms *A* and *B*, Fig. 11, one of which is operated by the cam *C*. The lower end of the rod fits over dowels which give it the proper angle for the screw hole.

After these holes are counterbored and tapped, the cap, which has been previously machined, is bolted into place and the fixture shown in Fig. 12 used for reaming the babbitt lining of the crankshaft bearing. The movable side-locating center is at *A*, the end center being at *B*. Both of these centers are operated by small bell cranks, these in turn being controlled by the cams *C* and *D*, which are mounted on the same shaft and

FIG. 15. BORING THE CAPS

FIG. 16. MILLING THE OIL GROOVE

AUTOMOTIVE CONSTRUCTION

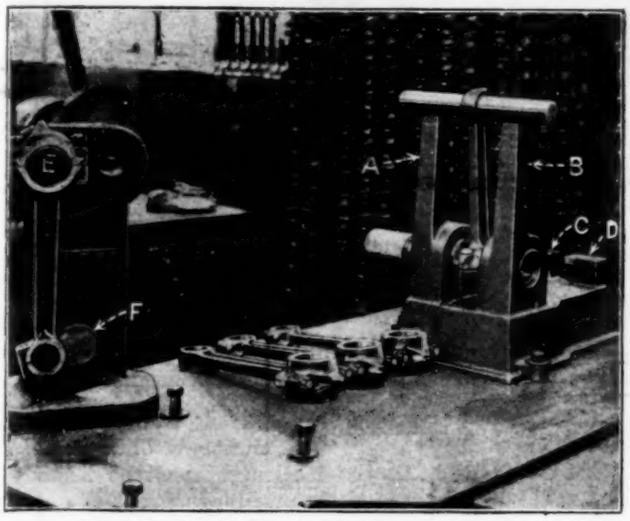


FIG. 17. THE INSPECTION BENCH

moved by a crank handle not shown. The reamer has the substantial guide *E*. After this, the ends of the babbitt bearing in both rod and cap are faced, the slot milled in the small end, and the rod finally straightened before going into the assembling department.

THE CONNECTING-ROD CAP

In the meantime, the connecting-rod cap has been finished on other machines, some of which are shown in the previous illustrations. The caps are heat-treated in the same manner as the connecting rods, and, after being tumbled, the joint face is finished on the disk grinding machine shown in Fig. 13. The fixture for holding the cap and forcing it against the wheel is very simple and needs no detailed explanation.

The bolt holes are next drilled in the fixture shown in Fig. 14, the cap being located from the bolt bosses and the V-shaped clamps being forced into position by the handle *A* which operates the cams *B* and *C*.

The caps are then bored in the fixture shown in Fig. 15. This fixture is mounted on the stripped carriage of an engine lathe and holds three caps at one setting. The caps are located by dowel pins in the bolt holes, and held in position by the adjustable clamps *A*, which are operated by the handles *B*. The cutters *C* are mounted on the bar shown and the lathe carriage is fed along on the bar, boring the three caps at once.

The sides are then faced, the caps washed, tinned and babbitted the same as the rods themselves. The babbitt is then trimmed by the rotary-file method, and the ends of the bolt holes spot-faced. After this the oil-splash groove is milled in the scoop which projects from the cap, this being done on the small milling machine shown in Fig. 16. This leaves only the oil hole to be drilled and the oil groove to be cut, after which the assembled rod and cap are ready for the inspection department.

A corner of the inspection department is shown in Fig. 17. This shows one of the standard forms of connecting-rod testing fixtures with the arms *A* and *B* and the plates *C* and *D* to show the squareness of the two holes in the different positions, the usual test bars being used in both ends of the rod.

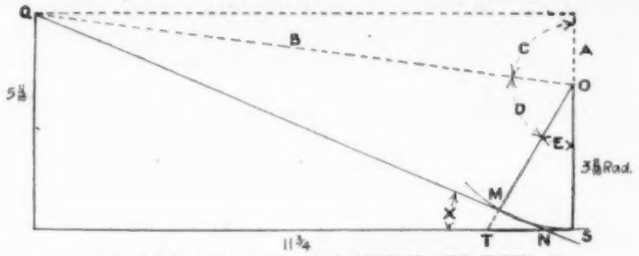
The other fixture tests the faces of the rod itself without the bars being in place. The large end of the rod fits over the pin *E* while the small end is swung past the surface *F* to test the two surfaces of the rod being parallel with each other. Some idea of the rods handled in this department can be had from the stack behind the bench. The rods are now ready to go to the assembling department.

Another Solution to "A Little Question of Trigonometry"

BY E. T. GOODCHILD

A simple solution to Mr. McCurdy's problem of finding the angle *X*, page 713, Vol. 51, of the *American Machinist*, is obtained by first joining up the center *O* to point *Q* and then completing the dotted-line triangle by drawing the other two sides parallel to the $11\frac{3}{4}$ and $5\frac{11}{16}$ lines. Then continue the line *OM* to cut the base line at *T*.

The problem is to determine the angle *X* when only the radius about *O* and the two distances given in



A PROBLEM IN TRIGONOMETRY—TO FIND *X*

figures are known. The solution is now easily found by examining the triangles.

$$A = 5\tfrac{11}{16} - 3\tfrac{11}{16} = 2$$

$$B = \sqrt{2^2 - 11\tfrac{3}{4}^2} = 11.919$$

$$\text{Tan } C = \frac{11\frac{3}{4}}{2} = \tan 80°20.4'$$

$$\text{Secant } D = \frac{11.919}{3\frac{11}{16}} = 11.919 \times \frac{16}{59}$$

$$= \text{Secant } 71°58.6'$$

$$E = 180° = (C + D) = 180° - (80°20.4' + 71°58.6') = 27°41'$$

But, in the two right-angle triangles *OTS* and *MTN* the angle *MTN* is common to both, therefore, the third angles are equal, or

$$X = E = 27°41'$$

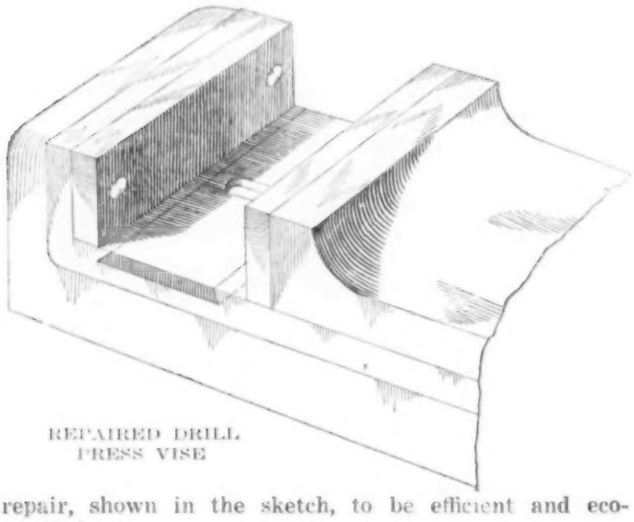
A doubt often arises in the draftsman's mind when tackling an awkward problem as to whether the data is complete enough for a solution. In such cases the following rule will be found very useful: If sufficient particulars are given to draw the diagram geometrically with straightedge, protractors and compasses, then the problem is solvable.

Incidentally the key to most problems involving circles or arcs is to connect the centers with one or more known points as is done, for example, in calculating dimensions when measuring dovetails with plug gages.

Repairs to Machine Vise

C. H. FRANK
Nagoya, Japan

In many workshops, vises used on the drilling machines sometimes become damaged near the solid jaw end because of the thoughtless or unskilled operators who do not use packing pieces under the work, but drill right through into the base of the vise. Instead of "scrapping" a vise damaged in this way or re-machining the base along the top—incidentally weakening it—and re-fitting the sliding jaw, I have found the method of repair, shown in the sketch, to be efficient and economical.



REPAIRED DRILL PRESS VISE

If the dovetail piece is made a push fit, it will not be necessary to use screws or rivets to hold it in place. Should the inserted piece become damaged it is an easy matter to push it out and insert another. A spare piece can be kept in stock if desired.

It is best to finish-machine the top of the dovetail piece level with the existing base after pushing it into place.

A Boring Bar of Merit

BY JOHN HOUSSMAN

The boring bar illustrated in Fig. 1 was used by the writer for some time in the Oil Well Supply Co., of Pittsburgh. Who is the originator of it I do not know, but I do know that it has one or two advantages over all the different styles of bar that I have used. First, there is no setscrew to mushroom; second, no wrench, either standard or special, is required; and third, small bottom clearance is required when boring blind holes.

The rod that holds the tool might well be made of drill rod, but the truth is that we made it out of an old ⅜-in. round file by grinding off the tang. Like the nutless bolt used in shipbuilding, only a hammer is needed to operate it, although in the hands of a lathe operator a toolpost wrench does just as well. This device makes the most efficient toolholder I have seen.

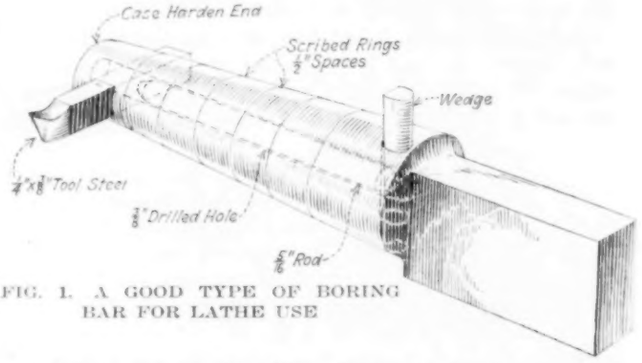


FIG. 1. A GOOD TYPE OF BORING BAR FOR LATHE USE

If I were a tap manufacturer not a tap would come out of my factory with the sharp-cornered square shank, as at *A* in Fig. 2, but every one of them would have a

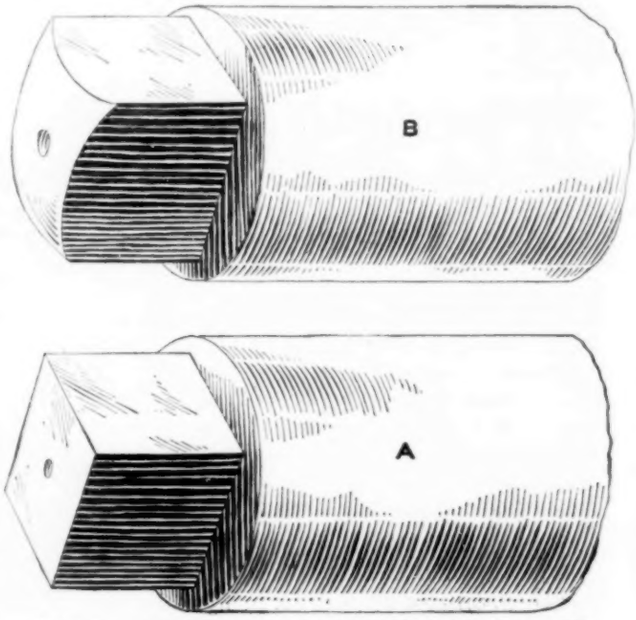


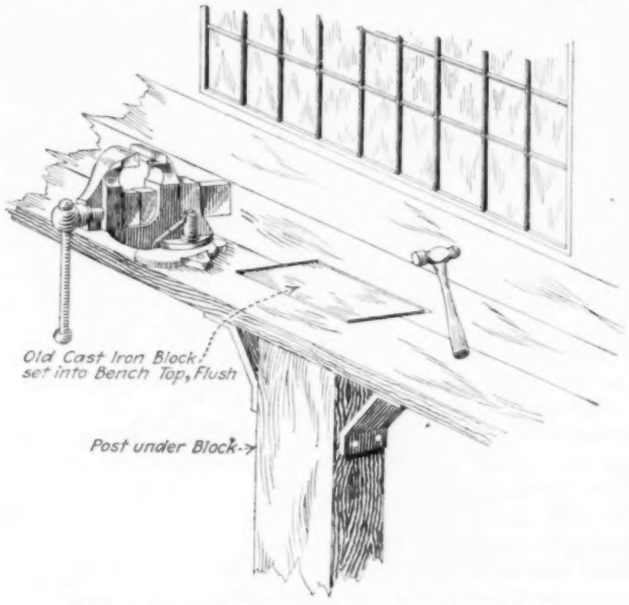
FIG. 2. DIFFERENT KINDS OF SHANKS ON TAPS

beautiful and generous chamfer on the top, as shown at *B*. Many a time I have fumed while trying to find the hole in the tap wrench, which has to be held just so, because the square on the tap will not enter until the two parts are in perfect alignment. The chamfered end would, however, enter slightly the hole in the tap wrench in any position, and a twist of the wrench would bring it into the proper position, so that it would slide down in place on the shank.

An Independently Supported Bench Block

BY CHAS. H. WILLEY

The annoyance of jars and vibration caused to toolmakers by each other when hammering work on the portable bench block has been overcome in our shop by



HOW THE BENCH BLOCK WAS SUPPORTED

setting the bench blocks into the bench flush with the top and supported by posts underneath, as shown in the sketch.

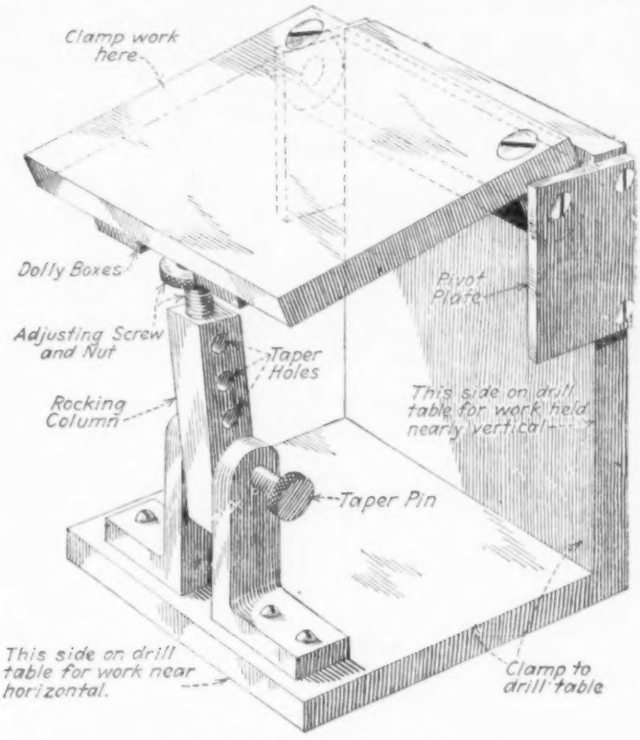
The block is set near the vise and being so handy prevents the common abuse of pounding work on the back of the vise. Being flush with the bench top it is not in the way when not in use.

Built-Up Adjustable Angle Plate for Light Drilling

BY H. H. PARKER

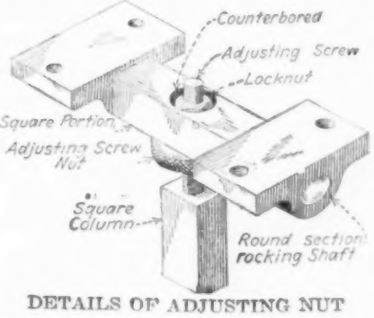
The sketch illustrates an adjustable drilling plate built up from a conventional cast-iron angle plate. Such a contrivance is useful around a drill press for drilling small holes at an angle, as it may be clamped to the drill table by either of its two sides, and quite a variety of angles obtained. As shown, the construction is formed of angle brackets, plates and square stock screwed together, though castings could be used to advantage if the cost of making the patterns would not be objectionable.

The tilting table is pivoted near the top of the angle plate and is held in any desired position by means of a square rocking column having a series of tapered holes drilled through it, while the fine adjustment is furnished through a nut working on the threaded end of the column. The nut is fixed in a rocking shaft held in two frames screwed to the bot-


Clamp work here
Dolly Boxes
Adjusting Screw and Nut
Taper Holes
Rocking Column
Pivot Plate
This side on drill table for work held nearly vertical
Taper Pin
This side on drill table for work near horizontal.
Clamp to drill table

AN ADJUSTABLE ANGLE PLATE

tom of the tilting table; the shaft is turned from a piece of square stock with the center portion left square and is drilled and counterbored for the nut. A short portion of the hub of the nut is squared and a washer with a square hole in it is driven over this and a locknut screwed down on top of it. This arrangement prevents the adjusting nut from working loose in its bearing. The nut should make an accurate fit on the threaded end of the column, without backlash. A substantial taper pin holds the column in place; this will probably have to be driven in by a light hammer. If the adjusting nut should prove difficult to turn by hand, a hexagon nut and wrench could be used or a series of holes drilled around its circumference and a pin inserted, making it into a capstan nut.



DETAILS OF ADJUSTING NUT

A New Designation for Bar Stock

The other morning the agent at the railroad station called up on the telephone. "Say! you fellers gotta lotta 1⅛-in. cold rolled down here. You gotta gettem right out; we want th' car."

"All right," we replied. "Tell Johnny, the truckman, to bring 'em right up."

An hour later we turned around to find John at our elbow. "Say boss," he said, "where'd yu want them solid pipes put?"

EDITORIALS

James Watt Not Inventor of Metric System

IN THE report from the Cleveland Chamber of Commerce, published on page 283, the "invention" of the metric system is credited to James Watt. This is a common error and probably owes its origin to the careless and ignorant statements emanating from the World Trade "Club." In their literature they say:

"James Watt is the man who thought out and suggested the metric system."

The evident intention of this is to create the false impression that the metric system is an English invention.

The fact is, the idea underlying the metric system, devised during the French revolution, was to establish a system whose basic units should be different FROM ANY EVER USED!

S. S. Dale says in his authoritative booklet:

"One of the essential features of Watt's common sense proposal was to retain the units that were in most extensive use. Watt proposed to decimalize the units and to establish a correlation between length, volume and weight of water. In this he was also retaining features that had become firmly rooted in the English system. Decimals had long been an essential feature of weights and measures for calculations. Correlation of cubic content and weight of water had been incorporated in weights and measures from the earliest times. The Babylonian talent of 80 pounds was the weight of a Babylonian cubic foot of water. The Roman cubic foot of water weighed 80 Roman pounds of 12 ounces each. The trade relations between Rome and Britain, beginning with Cæsar's invasion of Britain, necessarily brought Roman weights and measures into Britain. In 1685 "some Gentlemen of Oxford determined the weight of a cubic foot of spring water, or 1,728 solid inches, to be 1,000 ounces averdepois." That "averdepois" ounce (437½ grains) was almost exactly equal to the Roman ounce (437 grains).

"Correlation of cubic content and weight of water, handed down from the earliest times, was thus an established feature of English weights and measures on Nov. 14, 1783, when Watt wrote to Mr. Kirwan, proposing various plans for unifying the weights and measures of Europe. The following extracts from that letter and a later one to Mr. Magellan reveal the ideas Watt had in mind:

"My proposal is briefly this: let the philosophical pound consist of 10 ounces or 10,000 grains; the ounce consist of 10 drachms or 1,000 grains; the drachm consist of 100 grains. I would propose that the Amsterdam or Paris pound be assumed as the standard, being now the most universal in Europe; I have some hopes that the foot may be a measure of water and a pound derived from that. The common English foot may be adopted according to your proposal, which has the advantage that a cubic foot is exactly 1,000 ounces. I give the preference to those plans which retain the foot and ounce."

"The English speaking world has adopted the essential features of Watt's plan. The cubic foot of 1,000 ounces has been retained, and all the English units are decimalized for convenience in calculations." E. V.

Education for Employers

A REAL college course for the factory manager is an interesting development of modern education. To be sure it only lasts two weeks, but how many of the students could afford to spend much more time than that away from their jobs?

The course is one of the spec. summer courses at Pennsylvania State College and has been given for four years. It is under the direction of the Department of Industrial Engineering which conducts the work of the regularly enrolled college students in this branch of engineering during the academic year, and fills a long-felt want. Beginning with a classroom discussion of shop handling, the course takes the men through planning rooms and shops for demonstration of the theory. The students take up stores, cost, inspection, tool handling, order scheduling and control projects. Next they take time studies on a variety of machines and operators and set rates. All the various phases of management are thus analyzed and treated concretely by the plant owners, superintendents, accountants, purchasing agents, employment directors, production experts and consultants who, with foreman and clerical heads, make up the student body of this intensified summer college.

At one of the group sessions of the Chamber of Commerce of the United States at its spring meeting in Atlantic City, Dr. Eaton, of *Leslie's Weekly*, advocated education of employers and leadership for employees as the solution of industrial difficulties. All employers will probably agree with him that the present labor leadership leaves something to be desired, but how many of them realize their own deficiencies in the matter of liberal thinking? As the old nigger said "It makes considerable difference whose ox is gored."

We have heard it said that eighty per cent of American employers are badly in need of education along the lines of up-to-date factory management. While this is probably something of an exaggeration, it shows the need for just such courses.

Those men who would not get enough from two weeks' hard work under competent instructors in management principles and details, to repay the investment of time involved, are few and far between.

We are in hearty accord with plans for education of this sort, and we hope the number of available courses will multiply. K. H. C.

Retarding Airplane Development

THE recent decision of Judge Chatfield forbidding the sale of foreign-built airplanes in this country may be more far-reaching than appears on the surface. If, as it seems, this only prohibited the dumping of obsolete foreign-built plants on the American market, there would be little room for criticism. But it apparently goes much farther and may distinctly retard the development of commercial aviation in this country, the home of the airplane.

It does not seem to be generally known that Commander Bellinger, of the N-C 3 and a well known flier in every way, and Captain Hartz, the army flier who successfully piloted a large, double-motored plane clear around the rim of the United States, have been balked in their efforts to start commercial airplane lines by this decision.

They first tried to secure suitable ships from the different builders, but without success. For one reason or another, the builders declined to supply them with the airplanes needed. Desiring to begin operations as early as possible, they went to England to get ships for their work, but are now balked by the decision referred to. It is further claimed that the ships bought were built under license of some of the patents which are now being used to prevent the machines from being brought into this country.

It will be remembered that the airplane was first successful in the United States. But it must also be remembered that its development was much more rapid in other countries, owing to the dampening effect of the dog-in-the-manger policy of the owners of the Wright patents. It was only by defiance and subterfuge of various kinds that Curtiss and others were able to bring American planes to any sort of commercial development.

When the war came all the large airplane builders pooled their patents, but substantial royalties were not forgotten, as the records will show. And now these patents are apparently being used to retard the development of commercial airplane service, when the holders of the patents are unable or unwilling to supply the planes to be used.

The monopoly patent has been the target for much criticism from various sources, and cases of this kind make excellent ammunition for the opponents of the system. They call attention to the fact that the constitition grants a patent primarily "to secure to the community the benefits of the advances in science and arts," and that if patents are not used in this way the constitution is violated.

The dog-in-the-manger policy is never popular. There was general rejoicing when Henry Ford smashed the Selden patent and made it possible to develop the automobile without the sanction of the A. L. A. M. Those who really believe in the future of the airplane and are trying to develop it in various ways cannot but regret that so much effort should be spent in preventing, rather than in aiding, its development. All must realize that the more planes which come into actual use, the sooner will the industry be on a commercial basis. And if a monopoly of patents make it possible for other countries to outstrip us, we shall be the losers. F. H. C.

U. S. Manufactures to Be Exhibited in Argentina

MOST manufacturers are already so well acquainted with the coming Exposition of United States Manufactures at Buenos Aires, Argentine Republic, March and April, 1921, that the plan needs no further explanation. The exhibit is being conducted by the American National Expositions, Inc., Bush Terminal Sales Bldg., New York City, with the idea of furthering commerce and friendship between our country and South America.

This exposition is a step in the right direction for American commerce, as it appears that our manufacturers are at last trying for foreign trade in a systematic organized manner. Most foreign countries seem to handle such expositions and trade extension as government functions, since those countries are alive to the necessity of maintaining the proper commercial relations away from home. The Department of Commerce of the United States, while it does not conduct exhibitions of this nature, is enthusiastically rendering moral support to the undertaking.

The British Board of Trade is at present planning an exposition for South America similar to the one it held in Athens shortly after the war ended. Concerted action of manufacturers is secured by government control. It is said that although the competition offered by the British is keen, their methods are fair and aboveboard.

Dr. Julius Klein, Commercial Attache to Argentina from the Department of Commerce, has stated that Germany has for some time been shipping to South America an average of two shiploads of general merchandise a month in Scandanavian bottoms. Spain and Japan, too, are active in the South American market.

In other words, foreign nations are willing to deprive themselves of goods, which they need infinitely more than we need ours, so that they can keep themselves entrenched in the market. The reason for this action is that they are far-sighted enough to see that they will have great need for that market in a short time.

It is gratifying to see that reliable American firms are supporting the American exposition so well, this being particularly true in the machine-tool industry. It will probably be necessary to supply additional space for all those who wish to exhibit. The fact must be emphasized that only those exhibitors who expect to continue trade with Latin America on a sound basis are wanted. It would really harm our relations there if publicity were given to those manufacturers who desired South America merely as a dumping spot for scrap and surplus stock. If American manufacturers will play square they ought to be able to obtain and retain control of the South American market. Never will a better opportunity be presented than now. C. J. P.

Getting Down to Work

THE announcement by officials of the Pennsylvania Railroad System that 12,000 employees were to be laid off will bring sharply to the labor slacker's mind the fact that conditions are rapidly shaping themselves so that it will soon be impossible for him to obtain high wages for half-hearted and slovenly under-production. As long as men felt that they could easily find work elsewhere, at as good or better pay than they were receiving, there was little that could be done to induce them to give their employer value received.

Several large manufacturing firms have, within the past few months, laid off a considerable percentage of their undesirable workmen, with the result that their output per man has increased surprisingly. In several cases the total output is equal to that when they had 15 to 20 per cent more men!

Restriction of output or "lying down on the job" is poor policy, and the sooner the American workman realizes this fact the better. American employers do not fear to pay well, provided they receive full value n return. The old Golden Rule is a pretty good guide after all.

E. V.

WHAT to READ —for the man in a hurry

Suggested by the Managing Editor

What to read was not a difficult matter to decide two hundred years ago when books were few and magazines unheard of. It is far different now when so much reading matter is offered to pass the time pleasantly or profitably as the reader chooses. We are doing our utmost to make the "American Machinist" not only profitable but indispensable as a clearing house of ideas and news of the machinery world. This page is the editors' advertisement of their section of the paper. It gives the high spots

WE have used so much of Entropy's stuff lately (two of his observations are in this issue, Pages 248 and 266) that we think it high time to introduce him to the few readers of the *American Machinist* who are not already acquainted with him. While we ordinarily do not believe in letting a man talk very much about himself in the *American Machinist* we have found it difficult to improve on Entropy's brief autobiography so here it is. By the way, his real name is E. H. Fish.

"After graduating from Worcester Polytechnic Institute I put in eleven years in the machine-tool business beginning with the tin dinner pail and winding up as a designer. Some of the time I was superintendent of a small shop that made lathes and special machinery. . . . After that I took a fling at teaching and was at Worcester Tech. for six years; left there to start and run the Worcester trade school where I held down a more or less political job for five years.

"After these eleven years in the educational field I reformed and joined the staff of the *American Machinist* as New England editor for a short period. However, some of the local Worcester people discovering that an editor had very little to do, (This is an entirely erroneous impression of an editor.—Ed.) suggested my going to the Norton Co. where I was supposedly educational director but turned out to be employment manager, which, in that company means doing anything that nobody else wants to do. During this period I became interested in various societies and finally became acting president of the Boston Employment Managers' Association and vice president of the National Association.

"Soon after we got into the war, so many of the young men whom I had enticed into the Norton Co. began to enlist, that I became ashamed to be seen around the office and took various jobs as an alleged expert with the shipping board and other organizations in the employment line, and finally dropped into the Federal Board for Vocational Education where I still am."

E. H. FISH—"Entropy"

Mr. Fish has just announced his association with the Cooley & Marvin Co., of Boston, as Consulting Engineer.

Entropy has said so much that we won't have to add a great deal to fill this week's page. However, we want to mention the Stamets milling machine which has been given leading space, and the Metalwood press which is described on page 256. Both of these machines were designed for work on automotive crankshafts and are worth investigating.

The two-envelope pay system of the Oneida community which has met the advanced cost of living in a satisfactory manner is discussed on Page 249.

Toolmakers will find two articles of special interest in Part X of Macready's gage series on page 253, and "Accurate Lapping" by Vorhees on page 263.

A practical article on magnetic chucks by I. A. Hunt of the Heald Machine Co. begins on page 267.

On page 273 is another of Fred Colvin's automotive shop articles, this one taking up the machining of Fordson tractor connecting rods. The operation sheet is included as in the other articles in this series.

Report of the Cleveland Chamber of Commerce on the Metric System

FRANCE adopted the Metric System in 1793. In 1812, under Napoleon, the law was repealed and the French people promptly reverted to the old system called "Systéme Usuelle." In 1837, the metric system was again made compulsory in France. Despite the operation of this compulsory law for more than eighty years, it is stated that the old units are freely used in many industries in France; for example, the aune and denier are still used for measuring silk.

Many South American countries have adopted the metric system by compulsory and permissory laws. However, a survey conducted by the American Institute of Weights and Measures conclusively proves that the use of this system is not universal in these countries.

Argentina adopted the system in 1863. Yet an examination of the results of a questionnaire shows the use of many units unknown in the metric system. For example, land is sold by the square vara. In marine measurements the kilometer, meter, pie, ton, mile, knot and cubic foot appear to be used about equally.

Brazil adopted the metric system in 1862. The same condition is found there, with such terms as gallao, arroba, alqueire, etc., appearing frequently.

The adoption of the metric system in Chile in 1858 has apparently not altered the use of the old system in that country. The units libra, quintal, pie, vara and inch are found to be used in many industries.

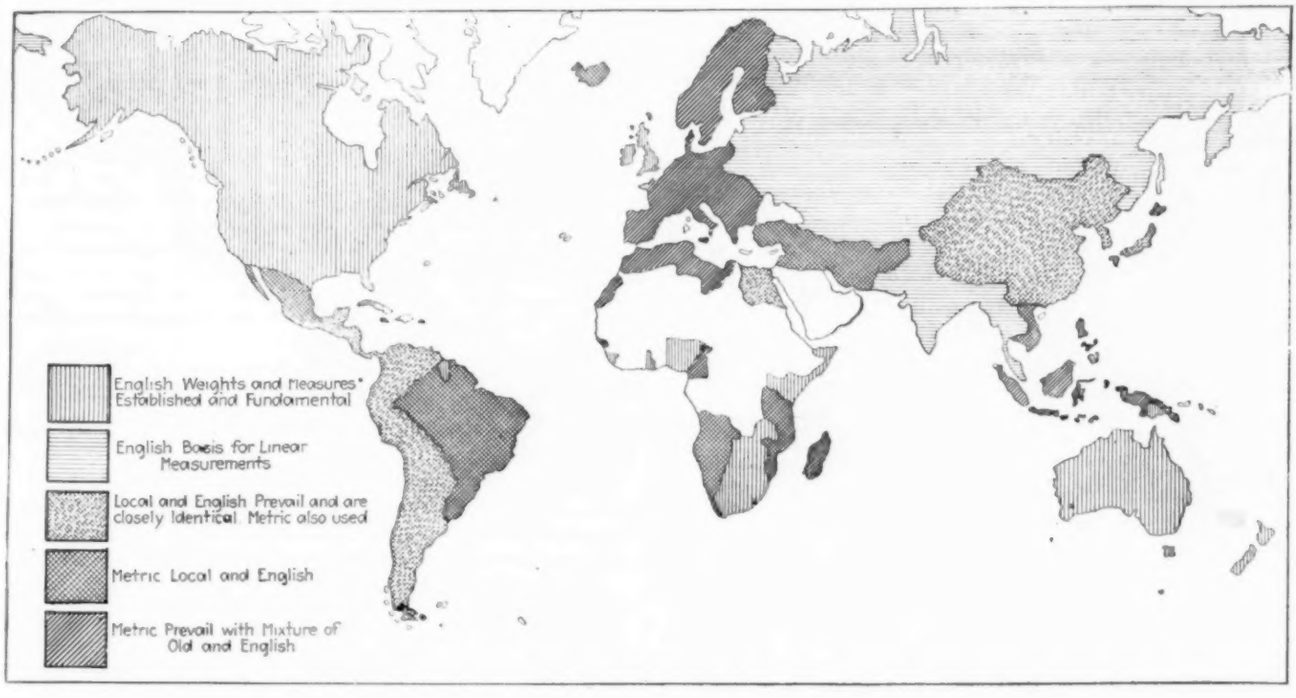
The same condition prevails in Colombia, which adopted the system in 1853. In fact, this is the condition prevailing in practically all of the South American countries.

With slight differences, the units other than the metric units in use in Latin American countries are remarkably similar to the English system.

The condition prevailing in South America is interesting in that, at the time of the adoption of the metric system by the several countries, little or no physical disadvantage, in the form of deep-rooted manufacturing practice, existed. Apparently the reluctance of the peoples of these countries to change is attributable to the greater convenience of their old system.

There is attached to this report a map reproduced from a report issued by The American Institute of Weights and Measures, which will show perhaps better than any other way the comparatively limited extent of the exclusive use of the metric system in the world.

It is stated on good authority that 50 per cent of all machine tools manufactured in the world are made in the United States. It is further stated that 82 per cent of the total business of this character originates in the United States and in Great Britain, both of which countries use the English system. These machine tools are the basis from which all manufactured products spring, and it is not only possible to do, but manufacturing in the metric system is being done constantly with machines and machine tools in which the great majority of the parts are built to the English inch measurements. These machines, in most cases, are standardized and in the case of frames, bases and parts of a similar nature, it makes no difference whether the machine is to be used for manufacturing products to English inch measurements or metric measurements. In the majority of cases the


English Weights and Measures Established and Fundamental
English Basis for Linear Measurements
Local and English Prevail and are closely Identical. Metric also used
Metric Local and English
Metric Prevail with Mixture of Old and English

MAP SHOWING THE COMMANDING POSITION OF THE ENGLISH SYSTEM

only changes which are necessary are in such moving parts as lead screws and some change gears and parts of a similar nature. Where a company is doing a considerable export business, these metric parts have also become standardized, so that they present no more difficulty in their manufacture than do the corresponding parts, which are built to English measurements.

Proponents of the metric system urge as their main argument the advantage that would result in export trade from its adoption. To this argument your committee takes exception.

Many things manufactured in the United States are sold in tremendous quantities in foreign countries without a particle of hindrance by virtue of the system of measurement by which they were made. Foreign automobiles sell in the United States without a thought being given as to whether or not they are made to the metric or to the English system, and it is a well known fact that the American automobile made to the English measurement system has invaded every known country in the world.

Examples of the ready sale abroad of articles made by the English system could be multiplied without end.

The American Institute of Weights and Measures recently conducted what might well be called a census of metric use in the United States. The response to their questionnaire is particularly illuminating when applied to a consideration of the foreign trade of many American manufacturers. For example, out of the replies received from automobile manufacturers, it was found that none were equipping their cars for foreign trade exclusively with tires and rims in metric sizes. In fact, the companies which perhaps do the largest automobile export business, such as Dodge Brothers, Ford, Maxwell, etc., ship their cars equipped exclusively with tires in American sizes.

The Paige-Detroit Motor Co. states that occasionally a request for metric spark plugs is received. They further state that such requests are few and far between, because of the predominance of American spark plugs, and that in eighteen months they have not shipped a single car so equipped.

Dodge Brothers, who ship more than a million dollars' worth of automobiles a year to foreign countries, equip all of their cars with standard English thread spark plugs. Instances of this kind could be multiplied practically without end.

The Cleveland Twist Drill Co., which has been in export trade for a great many years, reports that in its particular line 90 per cent of the shipments to France, Sweden, Italy and Spain are made in metric measurements; to other so-called metric countries, roughly, 50 per cent. But the great bulk of its exports go to countries using the English system—Canada, Australia, South Africa and Great Britain. The Cleveland Twist Drill Company is absolutely opposed to making the metric system of weights and measures compulsory.

The metric system was made legal in the United States in 1866, and is open for the use of anyone desiring to adopt it. Contracts drawn in this system are legal and binding.

It is now proposed to introduce into Congress a bill which, if passed, will make the use of the metric system compulsory in the United States. In the opinion of your committee, the enactment of such a law would cause inestimable loss to the manufacturing interests of the country, and would create confusion and chaos from which the country would probably not recover for years.

An idea of the chaos that would be created in everyday affairs may be gained from glancing over the following list of changes that would have to be made.

In domestic life:

Grocers' scales all require new poise weights, all notched balance beams scrapped and new ones provided, with new sliding weights.

Peck and bushel measures discarded.

Liter, larger than a quart, new containers required.

Hectoliter, equal to 2.8 bushels, not a practical unit.

Prices on all commodities to be readjusted to new units.

In culinary matters:

All recipes to be readjusted to kilogrammes and liters; cook books to be rewritten; general confusion in kitchen operations.

New milk bottles.

In other household affairs:

Gas meters to be replaced by new system of units of volume, or readings of meters taken in one system and converted into the other, to avoid scrapping meters in use.

Water meters in same category as gas meters.

Tape measures and yard sticks to be discarded.

In shopping:

Counter measuring machines to be reconstructed, yards to meters.

Dry goods to be folded at cotton and woolen mills in meter folds instead of yard folds, requiring change of machinery.

Photographic plates in common sizes to be known by awkward combinations of figures. An 8 by 10 plate becomes 203 by 254 millimeters.

Quires and reams to be displaced by decimal multiples, requiring changes at manufacturing plants.

All containers and cartons to be modified in sizes and shapes to be adapted to new unit sizes.

Shirts, collars and cuffs to be known by strange names of sizes. A 16-in. collar becomes a 406-mm. collar. A 187-mm. hat is worn instead of 7⅜ in.

In building materials and construction:

Abandon board measure and substitute square decimeters, centares, or ares.

Doors familiar to all builders as 2 ft. 6 in. x 6 ft. 8 in. become 762 x 2,032 mm.

An ordinary brick is 51 x 101 x 203 mm. Sizes of sash also are converted into strange units. Weights of tin, copper, zinc, lead sheets and plates placed before builders in unknown units, in awkward combinations.

Molds and pallets in brickyards to be changed to new units or inconvenient numbers used to represent sizes.

Earth excavation on basis of cubic meters, representing about 1.3 cu.yd. Designation of shovels and dippers in excavating machinery to be in fractions of cubic meters instead of definite yards.

All architects' drawings to be in new units, involving a most perplexing conversion of current building material units or made up on a system that will involve changes in all woodworking machinery to meet metric units.

In railroad affairs:

Change in position and renumbering of, say 100,000 mile posts, an incidental and minor affair relative to other changes.

Standard gage of track becomes known as 1,435 mm.

Changes in time-table mileages.

Books of rules rewritten and speeds given in new units instead of miles per hour. Slow boards all repainted with new speeds thereon.

Speed recorders scrapped or remodeled.

Employees instructed in new methods of estimating speeds.

Dimensions of all wheels, axles, standard parts of car construction changed into new units.

Railroad track and warehouse scales to be reconstructed into metric units. Capacity of cars to be in new units.

In public land surveys:

Lands in many states surveyed and staked out in townships, sections, quarter sections and eighth sections, in none of which divisions is there an easy conversion into metric units.

In reconveyance of lands, present deeds giving metes and bounds in English units would require expensive and elaborate efforts to put dimensions and areas in metric units, which if correctly made would still be unintelligible to most people.

As great as the confusion in the few respects above mentioned and as expensive as the process would be in all the usual affairs of life, these few enumerated examples pale into insignificance beside the cost involved in making the conversion in the manufacturing industries. The cost of the war is but a fraction of that which would confront the general industries of this country. Virtual scrapping of all small tools and fixtures would be faced by manufacturers were such an act of Congress passed.

A colossal fortune in changes of lead screws and screw cutting gears in lathes alone is involved.

In all machinery the changes become of such a staggering nature their mere contemplation is most depressing. Days would be required simply to state the number of changes involved in the industries.

The ravages of war have fixed definite limits of territory. The ravages of the metric system changes would be universal in domestic affairs.

Compulsory legislation in this matter would plunge the nation into economic disorder, wiping out values in billions of dollars.

A dual system is confusing beyond description. Two systems do not admit of being in common use. A gradual change, piecemeal, is impracticable. A sudden sweeping change would throw the entire country into disorder.

In the chemical laboratory the metric system is used. It is there because it has advantages in chemical work. It was adopted because of its advantages there.

The metric system would be adopted by the industries if it possessed advantages for them.

The rewriting of all text books, engineers' tables, the changes in architects' drawings, in mechanical drawings, the education of the personnel of machine shops and other industries in the use of a new system of units are matters of greater magnitude than any yet undertaken by this country.

Interchangeable manufacture is strictly an American invention. Indeed, it is referred to in Europe as the "American method." Standardization is for the purpose of interchangeability. American industries have spent time and money standardizing for the purpose of economical manufacture on an interchangeable basis and today outstrip in this respect European methods so far that there is no comparison.

Your committee is not able to believe that the adoption of the metric system will promote this sort of standardization and interchangeability. It is our opinion that it will not only retard this work, but that it will destroy all that has already been done, and that much time and money would have to be expended in making the change.

The metric system does not provide for the purpose of the manufacturer convenient units of measure. American manufacturers are accustomed to making micrometer measurements. *In gear cutting, for example, there is not a single pitch in the metric system that will fit the United States system now so universally used* An example of this is the 12-pitch gear which is used by thousands in this country. The closest pitch to this in the metric system is module 2. These gears will not run together because the thickness of the metric tooth measured along the pitch circle is .124 in., while that of the 12-pitch tooth is 131 in. thick. In order to run these gears together it would be necessary either to change the 2 module to 1.889 module, or to change our standard to 2 module. It would mean that millions of gears on hand would no longer be interchangeable, that millions of dollars would have to be expended for changing over and rebuilding gear cutters, and that the necessary gages for checking the product would become obsolete, except for the purpose of repairing old gearing.

A common automobile cylinder dimension is that of the $3\frac{3}{4}$-in. bore. It is a standard size and is turned out by one concern alone in quantities of 12,000 per day. This standard is so well established that pistons and rings can be secured to fit it in every city in the United States. The metric translation of this size is 95.25 mm. Would our manufacturers be willing to adopt, or would other countries be willing to adopt, this size of 95.25 mm., or would it not be found necessary to adopt a 95-mm. bore? If 95 mm. should become the standard, it is not difficult to estimate the effect on the manufacturer who would be forced to scrap his tools, fixtures, jigs, etc.

The United States makes more than one-half of the screw products of the world. Our system is the most interchangeable of any of the systems which are in use at the present time. The bolts and nuts made by one manufacturer are readily interchangeable with the corresponding sizes made by another manufacturer. It has even been found that our standard 1 in.-8 thread per inch bolts and nuts can be used with 1 in.-8 thread bolts and nuts of the English Whitworth system.

In the metric system there is not a single diameter of bolt or pitch which will fit those now being extensively made in the United States. The pitches in the English system are expressed in terms of a certain number of threads per inch of length; while in the metric system they are measured from a given point on one thread to a corresponding point on the next thread, and under this system all fine threads become an awkward fraction of a millimeter.

It was estimated at the time of the signing of the armistice that the gages, checks, etc., made for war munitions alone cost the government $30,000,000. At least half of these will be of no use to the War Department or to anyone else if a compulsory metric law is passed. This gives an inkling of the tremendous cost of making the change proposed.

The English system, for the purpose of manufacturing, is as susceptible to decimal division as is the metric system. Beginning with the inch it is customary to halve for each sub-division up to a convenient fraction, $\frac{1}{32}$ or $\frac{1}{64}$, beyond which micrometers and other instruments are adjusted to hundredths, thousandths and ten-thousandths, all of which units are practicable and usable.

In the metric system the first decimal subdivision of the meter is the decimeter, a unit 3.937 in. long, of no utility and rarely used. The next unit is the centimeter, a unit too large for good work and too small for use in distance measurements. The next is the millimeter, .03937 in., the most widely used unit because of the adaptability of its size value. This unit is about as fine as can be used on a steel scale. For tools and fine, accurate mechanisms a millimeter is too large, and so the next subdivision is the $\frac{1}{100}$ mm., which is .0039 in. The great bulk of good work in machine tool, automobile, tool working and other in-

dustries requires units between 1/10 and 1/100 mm. The one is too coarse and the other too fine. The result is the halving and quartering of millimeters to get usable units approximating 1/100, 1/1000 or 2/1000 of an inch. Thus, it will be seen that the advantage claimed for the metric system of providing a decimal system fails by virtue of this forced use of fractions.

A great majority of manufacturers are on record as opposing the adoption of the metric system under one of the three heads:

(1) It offers no advantage over the present system of inch measurements.

(2) It is a very expensive procedure to introduce.

(3) It will produce great complications during the period of transition.

Your committee, after consideration of its investigation and of the facts that have come to its attention, earnestly urges the Chamber of Commerce to go on record as being absolutely opposed to the compulsory adoption of the metric system of weights and measures in this country, and strongly recommends that the Chamber of Commerce direct communications to the members of the Committee on Coinage, Weights and Measures of the Congress of the United States, and to all of the representatives of Ohio in the Congress of the United States, opposing a legislation which will in our opinion be so disastrous to all of us.

Respectfully submitted,

J. C. BRAINARD
N. H. BOYNTON
EDWARD L. CHEYNEY
H. F. DEVERELL
THOMAS FERRY
A. W. HENN
ROBERT LINDSAY
G. E. MERRYWEATHER
FRANK A. PECK
J. H. SCOBEL
GEORGE T. TRUNDLE, JR.

The Committee on Industrial Development.

March 29, 1920.

ESTIMATED COST OF INSTALLING THE METRIC SYSTEM IN THE OFFICE, SELLING AND ADMINISTRATIVE DEPARTMENTS OF A LARGE CLEVELAND MANUFACTURING ESTABLISHMENT.

Expenditures Incurred Annually	Expenditures Incurred But Once
(1) *Publicity and Sales.*	
Extra salesmen necessary to cover present sales districts, due to delays in ascertaining customers' needs ..$10,000.00	Re-editing catalog, preparing new plates and re-publishing .....$15,000.00 Additional advertising campaign to instruct jobbers, dealers and customers in ordering particular products under the new system .....$25,000.00 Re-marking, re-labeling and general re-handling of goods now in stock $25,000.00
(2) *Billing, Accounting and Shipping Departments.*	
In distributing 1,500,000 tools monthly some fifty thousand items are billed to some ten thousand customers. The introduction of a new system of measurements will result in a huge increase in special orders; much confusion and numerical errors by customers in attempting to order under the new system; a heavy correspondence to correct these customers' errors; and also a heavy expense for shipping and rehandling of goods sent in error. The cost of this increased work over present costs is estimated to amount to 10 per cent in shipping, 30 per cent in billing, checking and cost accounting, and 40 per cent in stenographic expense, total $23,000.00	
(3) *Purchasing Department.*	
	Revising all data used in purchasing supplies ....$2,000.00 Loss on raw steel in stock due to increased wastage in turning down to metric sizes .....$25,000.00 [See under Mfg. Dept. for details.]
(4) *Financial Burden.*	
To render adequate service to customers, it will be necessary to greatly increase finished stock in standard millimeter sizes while still continuing to carry a large stock in English sizes re-marked in millimeter dimensions. This increased inventory will tie up at least $500,000 in additional capital. Interest, taxes and insurance on this investment at 8 per cent will amount to .....$40,000.00 Interest, depreciation, taxes, insurance and maintenance at 10 per cent on $50,000,000 of building and equipment needed to house this increased stock $5,000.00	Cost of 10,000 sq.ft. of additional shipping room and office space required to house the increased clerical force and increased finished stock, at $4.00 per sq.ft..$40,000.00 Increased office and store-room equipment required.$10,000.00
(5) *Administration Expense.*	
Increased charge for executives and executive assistants exclusively engaged in supervising the change from the old system to the new $15,000.00	
Total expenditures incurred annually.....	$93,000.00
Total expenditures incurred but once.....	142,000.00

MANUFACTURING DEPARTMENT

ALL EXPENDITURES AS SHOWN INCURRED BUT ONCE

(1) *Engineering Department*

The drawings of buildings, sewer and underground pipes, power equipment and the drawings of special machinery, jigs, fixtures, gages, and the whole line of product manufactured will have to be translated over to metric denominations. All dimensions except those which are multiples of 5 in. will be in fractions of a millimeter. These millimeter fractions must be retained because it will be impracticable to change the physical dimensions of most of the machine, jig and fixture parts.

A great many of the working lists will have to be made over because there is not space enough on them for these millimeter fractions. Where the work is to close tolerances, as in drill and reamer manufacturing, the translation from English to metric will have to be carried to 1/100 mm. in order that the combined tolerances in any straight line will not accumulate an error beyond the present over all tolerances. It will take two competent engineers and two assistants four hundred days at ten hours per day to make this change $16,000.00

(2) *Purchasing Department.*

All records will have to be translated into metric units to enable them to make proper comparisons for new purchases. Raw material on hand will have to be re-arranged to suit the new units. The stock of steel, 1,289 tons valued at $645,000.00, will have to be arranged to conform to the metric units, and in many cases the amount turned off of this steel to make the metric units will have to be increased to avoid scrapping it. This extra material wasted costs from 15 cents to $1.25 per pound. There will be 205 sizes, each, of three kinds of steel (615 sizes in all for regular product only) affected by this change. There will be 151 sizes each of two kinds of steel, the size of which is now finished, and any of this material left in stock at the time of change will be of no use for metric sizes.

(3) *Factory Office.*

Change in sizes of routing books	$500.00
A large majority of duplicates of special orders which are kept for a permanent record are English sizes, and the adoption of the metric system will make them almost worthless or require translation at a cost of	2,000.00
Change in all shop orders for tools in the factory, which have not reached the point of stamping	200.00
Additional rubber stamps for stamping orders	70.00
Change in sizes of the following forms of stationery: steel sheets, control cards, sales, production and new lots report, and lot number cards	50.00
Change in guides and inserts for the following files: Stock in process file, special order file, lot number file, statistical department's file	80.00
Two comptometers and one Burrough's adding machine in the statistical department discarded because these machines have eight rows of countng keys. With the metric system it will be necessary to carry out the sizes to three decimal points and in checking the punching and tabulating by adding the sizes on these machines, it will be necessary to have machines with ten or twelve rows of counting keys. The cost of the new machines would be.....	1,365.00
It will also be necessary to add two or three counters to the size field on the tabulating machine for the same reason as above stated. This will mean the designing of a new machine. [Cost unknown.]	
Total cost of equipment	$4,285.00

(4) *Production Department.*

Cost of measuring instruments calibrated in inches which cannot be changed over.....	$19,000.00
Cost of re-marking measuring instruments which can be changed.....	4,000.00

Re-marking existing standards and gages which would have to be retained as special metric sizes	3,000.000	
Additional metric standards and gages	3,200.00	
Re-labeling pigeon holes, racks, etc., in factory	1,500.00	
Additional pigeon holes, racks, etc., to carry new stock	5,000.00	
Re-printing production forms, records and statistics (This includes cards and forms for tabulating machines, punching machines and collecting machines.)	20,000.00	
Guides used on machinery which would be obsolete due to changing size	15,800.00	
Immediate replacement	15,800.00	
Stamps, etc., obsolete	8,000.00	
Additional labor to get present production due to confusion, $3,200.00 per month for first year	38,400.00	
Cost of training employees to use metric measuring instruments	20,000.00	
Spoiled work under most favorable conditions, $5,000.00 per month for first six months, half of this for next six months	45,000.00	
Re-modeling jigs and fixtures on machines to suit metric sizes	20,000.00	
Nothing allowed for bolts, screws, nuts, gears, cutters, etc., whose dimensions would be translated into fractional metric sizes and their physical sizes maintained, rather than have two standards with the resulting confusion		
Total expenditure for Production Department		$218,700.00
Grand total expenditure for entire plant		$473,965.00

The Employment Department and the Plant Publication

By John T. Bartlett

The employment department sees the new employee first, and after that, normally, it sees very little of him. The average workman hasn't any great love for employment departments, necessary as they are to him when he finds himself looking for a new job. He associates them, oftentimes, with tough luck and discouraging experiences, and thinks of the employment manager and his assistant as possibly human but engaged in essentially a crape-hanging occupation.

True, recent years have changed things (in some cases most radically) but the new employee still regards the employment department as a necessary evil, and a place he wants to get through with as quickly as he can.

Despite the unmistakable atmosphere which envelops it, and its own peculiar position within the organization, the employment department can make effective, constructive use of the employees' magazine. Its position, for one thing, makes it the natural department to perform the first ceremonies of introduction. It stands between the organization and the strange new man. On behalf of the organization it learns things about that man. It is only fitting in return that the employment department should tell the new man something about the organization.

Employment managers are beginning to use the ideal instrument in this connection, the employees' magazine. They have stacks of recent issues handy. It is a simple thing to say, "Here! Take these and look them over. It will help you to get acquainted with us." If a delayed decision is involved, and the applicant goes away to call again in a day or two, he has these bright, companionable employees' magazines to read. They help to keep him sold on the applied-for job.

Moreover, he gets familiar with names. He catches some of the spirit of the organization. When he goes to work, the newness wears off the faster. He coalesces. He is the more quickly a "broken in" employee.

In many organizations where there is still personal contact, it is the traditional habit for the "old man," when hiring a new man, to give the latter a little intimate talk on the old man's ideas about things, what he asks of employees and what he gives in return. It is a fine old tradition, and many a man who has climbed within a company dates his new feeling about things, a feeling which determined his ultimate success, back to that first intimate little sermon by the "old man."

That first talk started the new employee right. Coming from another job, and an organization with different ideals, he likely had preconceived views which would have fatally remained in his own path. But the "old man's talk showed him "where he was at." It indicated a clear track ahead, so long as certain simple fundamentals were respected. He didn't have to acquire a friendly feeling for the new company. He felt it to start with. He believed in his new employer.

A List of New Employees

Some employees' magazines—and the number will probably grow—print lists of new employees by departments. *Delco Doings*, of the Dayton Engineering Laboratories Co., does this. So does *The Heater*, of the Westinghouse Electric Products Co.

The published name is in the nature of a formal introduction. It will please the new employee and it will keep the old ones informed of the additions. In these days when hiring with a particular concern hasn't as much dignity as it had when jobs were less easy to get, and when some workers are inclined to change jobs for little reason, the published list has special psychological value. It carries a suggestion of permanence. It suggests that entering the employ of the company is a serious thing, and one not to be considered lightly. This is a little point, but many such points all combined make a big one.

The employment department should use the employees' magazine for instructional purposes, just as other departments should. This little notice, signed by the employment manager, is taken from a publication beside me:

"Change of Address.

"The above heading is one of the most important items on a man's history card. Yet it is an item very often neglected by the rank and file.

"Occasions have arisen when a man has been rendered unconscious. The first aid department secured his last known address from the employment department. After probably a run ten miles out into the South End in the car, it is found he has moved and lives within a block of the plant.

"Two men lost jobs recently through not reporting their changes of address. They had been laid off, but a day or two later their foremen wanted them back again. They had both moved from the addresses given when they were employed and no trace of them could be found.

"If you have changed your address since you last passed through the employment office, ask your timekeeper for a change of address slip. Fill it in, and return it to him. By doing this you will help us and at the same time help yourself. Remember it is very necessary that we have every man's proper address and his telephone number, if he has one."

In such small uses as this, the employees' magazine is an important adjunct to the business. In its larger uses, some of which the employment department especially participates in, it is of still greater significance.

SHOP EQUIPMENT NEWS

-Edited By-
E. L. DUNN and S. A. HAND

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs and equipment

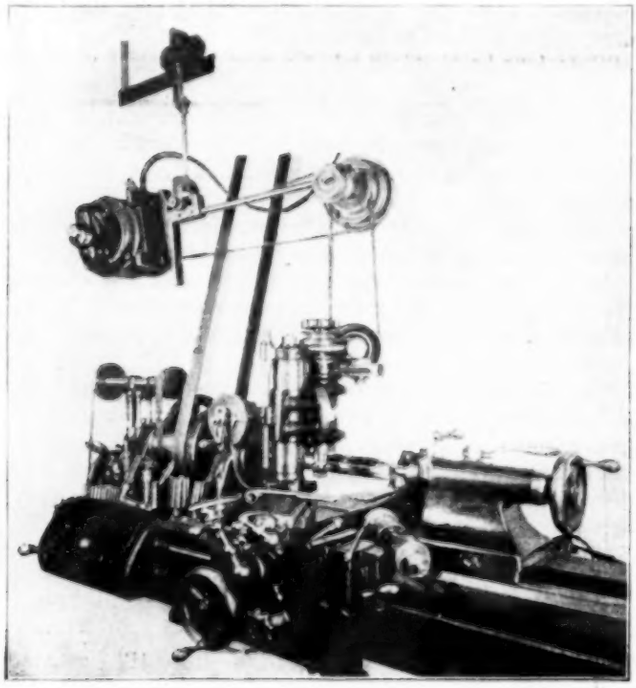
Moor Milling and Grinding Attachment

The milling and grinding attachment illustrated herewith has been recently placed upon the market by the Eccles & Smith Co., San Francisco, Cal.

The attachment consists of a vertical column carrying a saddle having either a milling or a grinding quill mounted thereon; a motor-driven countershaft suspended from a trolley rail; a driving wheel and indexing arrangement and an auxiliary countershaft.

The device is attached to the tool rest of the lathe by a central bolt through the column. The saddle can be raised or lowered on the column by a micrometer screw and can also be rotated around the column to any desired position. The quill mounting is attached to the saddle by a swivel base graduated in degrees. The milling spindle can be driven by worm gearing, as shown, for heavy cuts or slow speeds, or the worm gearing can be disengaged and the spindle run direct at high speed from a pulley. The dividing worm-wheel is attached to the lathe spindle by a faceplate, an indexing arrangement of the usual type being provided.

Longitudinal feed is belt driven from the small step of the cone pulley through an auxiliary countershaft to a grooved pulley on the change-gear shaft.



MOOR MILLING AND GRINDING ATTACHMENT

The milling spindle and quill can be easily removed and the grinding quill and spindle substituted.

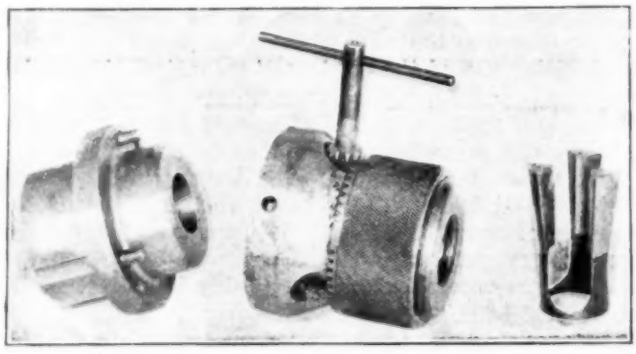
The countershaft is direct motor-driven and is suspended from an overhead rail through a universal joint, the motor overbalancing the drive pulley, so far as to keep the proper tension on the vertical belt. As the whole overhead arrangement is free to travel in a direction parallel with the lathe shears and can swivel in any direction, the milling or grinding attachment can be moved to any position on the lathe shears without cramping the belt.

Ney Draw-In Collet Chuck

The J. M. Ney Co., Hartford, Conn., has placed on the market the draw-in collet chuck illustrated herewith.

The chuck requires no tube or draw-in rod through the machine spindle as it is mounted on the spindle nose by means of a threaded adapter which is furnished with the chuck.

Rotation of the sleeve produces longitudinal travel of a shouldered nose-piece which bears on the end of the collet and forces it into a cone-shaped opening in the chuck body. Tightening pressure is obtained by the pinion key. The longitudinal thrust between the body and sleeve is taken by twenty-six hardened balls.



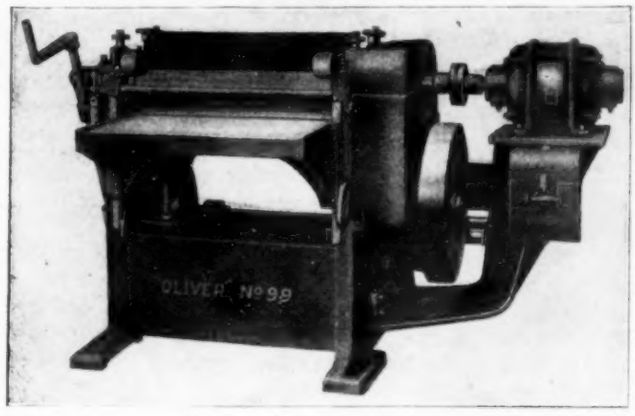
NEY DRAW-IN COLLET CHUCK

All parts of the chuck are made of machine steel, pack hardened, and ground on the working surfaces.

Each chuck is furnished with six hardened and ground tool-steel collets ranging in capacity from $\frac{3}{8}$ to 1 in., advancing by $\frac{1}{8}$ in. As each collet may be used on work $\frac{1}{16}$ in. over- or under-size, considerable flexibility is provided. Collets can also be furnished advancing by $\frac{1}{16}$ in.

Oliver Motor-Driven Surfacer

The Oliver Machinery Co., Grand Rapids, Mich., has arranged its No. 99 surfacer (which was formerly a belt driven machine) for motor drive, as shown in the illustration herewith.

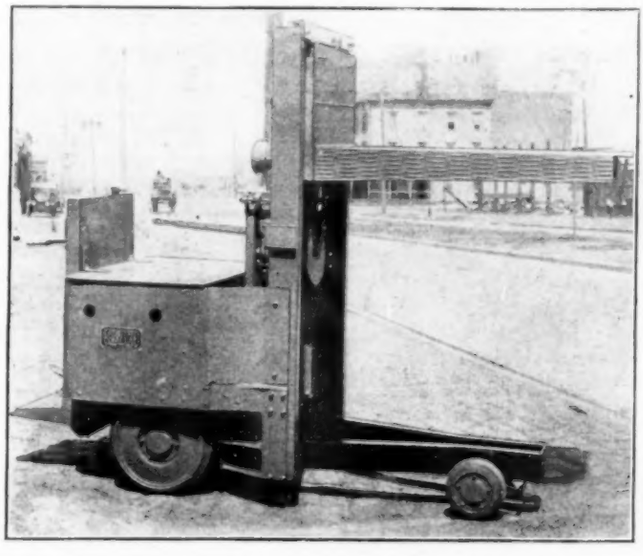


OLIVER MOTOR-DRIVE SURFACER

The drive to the cutter cylinder is direct from a standard motor running at 3,600 r.p.m.

Karry-Lode Tiering Truck

The Karry-Lode Industrial Truck Co., Inc., Long Island City, N. Y., has added to its line a lifting and tiering truck which is intended for use over smooth, level floors. The truck has a lifting capacity of 4,000 lb. at the rate of 3 ft. per min. and will deliver its load 65 in. above the floor. The platform is 26 x 54 in. in size and when in its lowest position is 11 in. above the floor. The hoisting is accomplished by a motor connected to a winding drum through a train of gears and a multiple disk clutch. The motor is allowed to accelerate to full speed before the clutch is applied to pick up the load, thus materially reducing the consumption of starting current. The platform is lowered by gravity, the speed being governed by an internal ratchet working in conjunction with the brake. The platform is controlled by means of a single lever that is located conveniently for the operator when in position on the step. A substantial drum-type controller is provided and the battery box is spring suspended and cushioned on all sides.

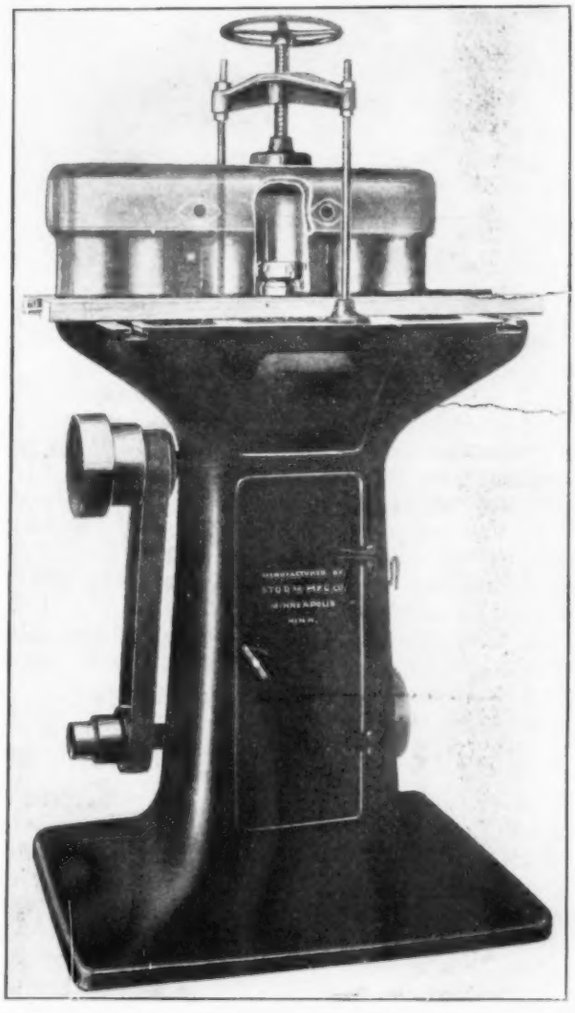


KARRY-LODE TIERING TRUCK

Storm Vertical Boring Mill

The Storm Manufacturing Co., 6th Ave. and 4th St., Minneapolis, Minn., has placed on the market the boring mill illustrated herewith.

As may be seen from the illustration, the boring bar works from beneath the table. The machine is intended for a variety of boring and provision has been made to protect the bar and bearings from chips.



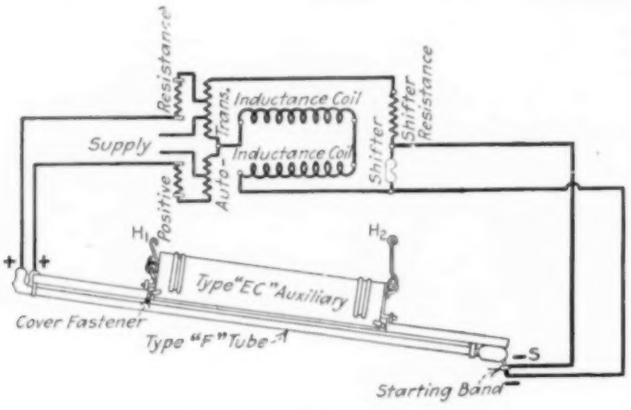
STORM VERTICAL BORING MILL

Specifications: Capacity; holes from 2⅝ to 7⅝ in. diameter and 20 in. depth with regular equipment; extra equipment can be furnished for holes up to 12 in. diameter. Floor space, 30 x 36 in. Height, 44 in. Work table, 24 x 30 in. Boring bars, 2⅝ in. diameter, 38½ in. long. Approximate shipping weight 1,000 lb.

Four cutting heads are furnished as part of the regular equipment, each head having six high-speed helical cutters which can be universally adjusted for size. Positive feed is obtained through gears and a central feed screw. An automatic stop is provided so that when a hole has been bored to a predetermined depth, the boring bar will return to the starting position and cease revolving. Variable speed is obtained through a countershaft and three-step cone pulleys.

Cooper-Hewitt 85 Per Cent Power-Factor Lamp

The Cooper-Hewitt Electric Co., Hoboken, N. J., has developed a new type of auxiliary for use with its alternating current lighting units, which has raised the power factor of the lamps from 52 to 85 per cent. This has been accomplished by replacing the choke coils of the former auxiliary by a positive low resistance unit, as shown by the diagram. Further advantages of the auxiliary are a saving of 14 lb. in weight over the old type, and an increase in the allowable voltage variation, since



SIMPLIFIED WIRING OF AUXILIARY

the lamp has a regulation of 25 per cent, while that of the old type was only 12 per cent.

The wattage of the lamp is 430 which has increased the candlepower about 12 per cent. Since the tube will operate at 3.8 amperes d.c., normal, a further slight reduction has been made possible, as the auto-transformer need not be as heavy as formerly.

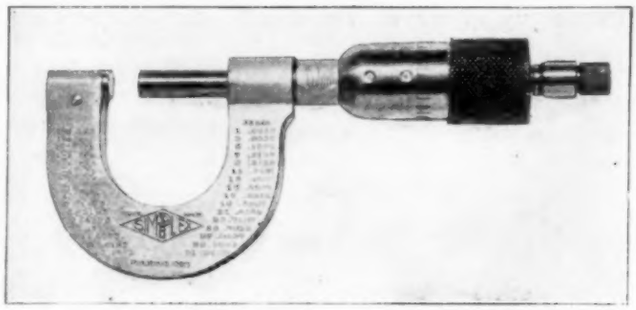
The lamp is adapted to alternating current circuits only, and can be used only on its specified frequency and within its own voltage range.

Simplex Self-Reading Micrometer

The Consolidated Tool Works, Inc., 261 Broadway, New York City, is putting out a micrometer designed to minimize errors in reading, whether the tool is used by expert mechanics or comparatively inexperienced workmen. The tool, instead of depending upon the matching of lines on thimble and barrel and counting up the lines exposed to get the measurement, carries on a part of the thimble a two wheel dial which in connection with the figures of the barrel shows the reading directly in numerals.

The part of the thimble nearest the frame does not revolve, but slides along the barrel to which it is splined. Two small dials within this part are actuated by the revolving thimble in such a way as to show through the windows the numerals that correspond to the position of the measuring spindle. Thus when a measurement is taken tenths are read from the last figure exposed on the barrel, hundredths from the wheel at the left and thousandths from the wheel at the right of the dial.

Any measurement in even thousandths within the capacity of the tool is thus shown without reference to the lines, while half and quarter thousandths may be estimated from the position of the zero line on the thimble.



SIMPLEX SELF-READING MICROMETER

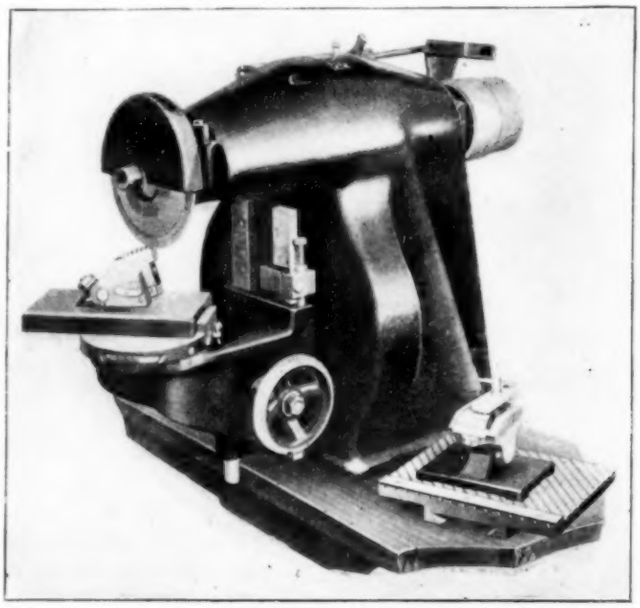
The tool is made in all regular sizes from one to six inches and in metric sizes from 25 to 150 mm. reading in hundredths of a millimeter.

It is furnished with or without ratchet stop or locknut, or with both, as desired. It is claimed to be accurate to one-ten-thousandth of an inch. The one- and two-inch sizes have full-finished frames with the table of decimal equivalents stamped upon them. Larger sizes have semi-finished frames.

Rickert-Shafer Chaser-Grinding Machine

Rickert-Shafer Co., Erie, Pa., has added to its line the chaser-grinding machine shown in the accompanying illustration. The machine is designed especially for grinding chasers of self-opening die heads. Either column- or bench-type machines can be furnished, and they can be equipped for either motor or line-shaft drive. Both the faces and the throats of chasers can be ground. For grinding faces, the fixture shown on the bench is used, adjustments being provided for varying the rake. The fixture shown on the machine is used when grinding throats, it being possible to grind chasers used for threading stock from ¼-in. to 6-in. diameter, the radius of the throat being varied by changing the angle between the axis of the wheel spindle and the fixture slide.

S. K. F. ball bearings are used throughout. The wheel is rubber corundum of 6-in. diameter.



RICKERT-SHAFER CHASER-GRINDING MACHINE, BENCH TYPE

Federal Rotatable Head Two-Spot Welding Machine

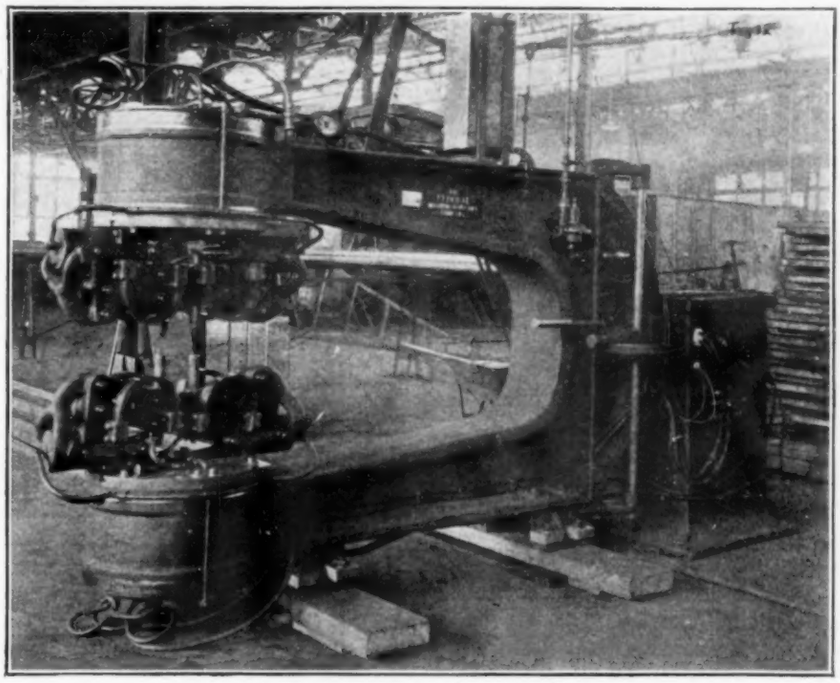
A rotatable head two-spot, air operated welding machine, has been developed by the Federal Machine and Welde Co., Warren, Ohio.

It has a 60-in. throat depth and is guaranteed to weld from two thicknesses of 24-gage up to two thicknesses of 8-gage steel stock. Twelve welds per minute may be made in the latter size.

The machine is built with a 4 kva. welding transformer in the upper and lower rotating heads. Primaries are in parallel while the secondaries are in series, so that two spot welds must be made at the same time.

The welding electrodes or points are 1½ in. in diameter, are carried in water cooled holders, and are so arranged that welds from 3 to 8 in. apart may be made. The ends of each set of welding points can be separated a maximum of 5 in. The heads can be rotated through an angle of 90 deg. to permit welding at different angles on the stock being handled.

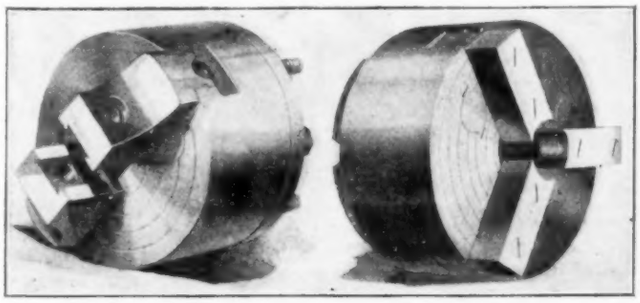
Four air cylinders are used, each operating an independent point. The air control is hand operated and so arranged that an initial air line supply pressure of 80 lb. will give from 300 to 700 lb. pressure between the points during the heating period. A second step on the air control makes it possible to apply 1,200 lb. pressure between the points for the final squeeze. The air is exhausted into the reverse side of the cylinders to withdraw the points. The regulating transformer supplies power to the welding transformer in eight voltage steps.



FEDERAL WELDING MACHINE

Redesigned Lavoie Air Chuck

The original Lavoie air chuck manufactured by the Frontier Chuck and Tool Co., 30 Letchworth St., Buffalo, N. Y., and described in the *American Machinist*, Vol. 51, page 484, was designed principally for shell work. The chuck has since been redesigned, making it adaptable for general commercial purposes. The same principle of operation is employed as formerly, but the overhang has been reduced, reversible jaws have been provided and other refinements added. The chuck is of simple construction, requiring but one packing and single piping. The grip is released by exhausting the air, a coil spring returning the piston to its original position. The chuck is made in two types as illustrated, one having two jaws, the other three jaws. The two-jaw type is made in three sizes, 6, 9 and 12 in., and is intended for brass work and odd shapes that require a simple method of chucking. The three-jaw type is made in four sizes, 10, 12, 15 and 18 in., and is used on general production work. The equipment includes one set of manufacturing jaws, one set of jaw pads, rough adapter casting, air box, and a quick-acting air valve.

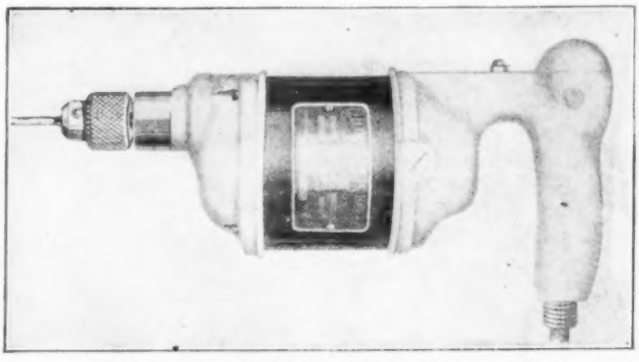


REDESIGNED LAVOIE AIR CHUCK

Electro Portable Drilling Machine

The portable electric drilling machine shown in the illustration is manufactured by the Electro-Magnetic Tool Co., 2902-8 Carroll Ave., Chicago, Ill.

The handle of the drill is of the pistol-grip type. The motor is series-wound, fan-cooled, and operates on voltages either 10 per cent above or below the normal. Adjustable ball bearings are used on the armature and a ball thrust bearing on the spindle. The reduction gears are of heat-treated alloy steel and easily removable. They run in grease in a cast-aluminum case, which is so constructed as to exclude grease from the motor chamber. A 3-jaw chuck is used. The machines are built in a range of sizes, having a capacity up to ¼-in. drills. The full load speeds vary from 750 to 8,000 r.p.m. and the weights from 4 to 8 pounds.



ELECTRO PORTABLE DRILLING MACHINE

Wickes and Niles Companies Form Machine-Tool Combine

Among the recent interesting developments in the machine-tool trade, has been the purchase of the controlling interest in the Wickes Machinery Co., of Jersey City, N. J., by F. H. Niles & Co., Inc., of New York.

H. W. McAteer, president of the American Steel Export Co., is chairman of the board of both companies, each of which will be continued under its own name. F. H. Niles, president of F. H. Niles & Co., becomes vice-president of the Wickes Machinery Co., while F. A. FitzGerald continues president of the Wickes Machinery Co. and becomes vice president of F. H. Niles & Co.

This action on the part of the Niles company becomes necessary in order to meet the demands of its rapidly growing business and to provide a more complete service.

The Wickes Machinery Co. succeeded some time ago to the business of Wickes Bros., who were engaged in the machinery and power equipment for over 40 years.

The New York office of Wickes & Co. will be in the office of F. H. Niles & Co. in the Woolworth Building. This latter company in addition to its used machinery business, also represents in the New York territory the following firms:

Cisco Machine Tool Co., lathes; Hoefer Manufacturing Co., upright drills; John Steptoe Co., shapers and millers; West Tire Setter Co., helve hammers; Easey Wolf Machine Co., electric portable tools; Mueller Machine Tool Co., radial drills; Hawley Down Draft Furnace Co., oil burning and electric brass melting furnaces; Berkshire Manufacturing Co., molding machines.

Trade Board to Fight Suit of Steel Companies

The Federal Trade Commission has filed its formal answer to the suit of twenty-two steel companies contesting its authority to require monthly reports relating to cost of production. The document was filed in the District of Columbia Supreme Court. A temporary restraining order was issued recently against the commisison. Pending a final determination of the same the commission is gathering monthly reports only from such steel and coal companies as choose to furnish them voluntarily. The document holds that Congress has the power to regulate such business when it affects interstate trade.

Georgetown Students Welcomed at Venezuela

The impressive reception accorded to the 25 students of the Georgetown University Foreign Service School, who recently arrived at Caracas, Venezuela, to study the economic conditions of our South American neighbors, has impressed American manufacturers with the importance of sending many more such groups to the various Republics of the South and to the Far East, says the the National Foreign Trade Council.

America can never hope to establish herself permanently in foreign markets until the American youth has been instilled with the desire to adventure into far-off countries with the idea of residing therein. It is strange but true that although a race composed of emigrants from all corners of the earth, citizens of the United States are very reluctant to migrate to other countries.

The American manufacturer can send out thousands of catalogs, commercial travellers, and other agents; but never will the result equal those obtained by the use of a sample of his product on the spot by one who knows how to use it. The American office equipment used in our Consulates abroad, and the household articles used by the missionaries, have been the means of promoting more sales than any number of "snappy" letters written from the home office to a native agent.

Colleges and the Metric System

By Thomas E. Butterfield
Associate Professor, Mechanical Engineering, Lehigh University

My college enthusiasm for the metric system did not survive my employment as an engineer in Germany, the chief metric country; I found that the metric system was not in universal use there after a generation of compulsory legislation, and also found the use of the metric system of no advantage in engineering computation.

Further careful study for years has convinced me that the fancied logical advantages of the metric system are *illusory*, and that the agitation in favor of its adoption is *harmful* to American industry and to engineering education.

J. M. Larkin Heads Industrial Relations Body

J. M. Larkin, assistant to President E. G. Grace, of the Bethlehem Steel Co., Bethlehem, Pa., will direct the destinies of the Industrial Relations Association of America for the coming year. He was the unanimous choice of the members of the Board of Directors at their annual reorganization meeting held in Atlantic City. Mr. Larkin is ably qualified for the place, being one of the few industrial relations men of the country who have been given recognition as such by a seat on the Board of Directors of his company. His handling of the Representation Plan in effect at the plants of both the Bethlehem Steel Co. and the Bethlehem Shipbuilding Corporation has won the highest esteem, of both the company and himself in the estimation of the workers.

Mark M. Jones, Director of Personnel of the Thomas A. Edison industries, whose resignation as Executive Secretary was received and accepted to be effective September 15 at the latest, was elected vice president. A change in the constitution of the organization is being planned to allow the election of six other vice presidents, each one of whom will be assigned to a specific territory.

F. C. Parker, executive officer of the Central Y. M. C. A., Chicago, and Secretary of Chicago Council, Industrial Relations Association of America, was re-elected secretary for the second time.

W. H. Winans, of the Union Carbide and Carbon Co., New York City, was elected treasurer. For the present the administrative offices will remain at Orange, with E. A. Shay, the assistant secretary of the association, in charge. A meeting of the Board of Directors will be held in Buffalo on July 30 to formulate a program for the coming year and to elect a successor to Mr. Jones.

The administrative offices are now engaged in preparing for publication the proceedings of the Chicago convention in May, at which between 2,000 and 3,000 Industrial Relations workers and executives of all classes were in attendance.

British-French Combine Acquires Austrian Works

Guest, Keen & Nettlefold, of Birmingham, England, in conjunction with Jagy & Freres, of Paris, have acquired control of the two largest screw works in Austria, those of Brevillier & Co. and A. Urban & Sons. The purchase price is said to be about £150,000 ($729,975).

LD'S INDUSTRIAL FORGE

News Editor

Wright Corp. Explains Court Decree

Recently published newspaper articles concerning the suit of the Wright Aeronautical Corporation, owner of the basic Wright airplane patents, against the Interallied Aircraft Corporation have resulted in misunderstanding as to the right of the Interallied Aircraft to sell its Avro and Sopwith airplanes. The final decree of the court in that suit did prohibit the further sale or use of these airplanes, but the Interallied Aircraft Corporation has made an agreement with the Wright Aeronautical Corporation so that all the planes which the Interallied Aircraft now has and is selling are licensed under the Wright patent, and the Interallied Aircraft has the absolute right to sell them.

No purchaser or user of the airplanes sold by the Interallied Aircraft has any reason to apprehend any legal difficulties with respect to the Wright patent. Purchasers or users of unlicensed foreign airplanes do run the danger of becoming involved in expensive patent litigation, but the planes of the Interallied Aircraft are guaranteed licensed under the basic Wright patent.

Germany Buying Steel Plate and Foundry Iron

An interesting feature of the latest foreign trade situation is the report from abroad that German manufacturers have just booked orders from Japanese interests for several million tons of steel plate. On the other hand Germany is buying considerable quantities of foundry iron in this country, three large inquiries being reported from Hamburg and Frankfort within the week and shipments have been made to these cities recently via Rotterdam. Other European countries are buying heavily in the United States, but manufacturers and exporters are not at all anxious for this business under present transportation conditions.

Electrolytic Zinc Smelter To Be Opened in Norway

Announcement is made in the *Norwegian Commercial and Shipping Gazette* (Norges Handels og Sjofartstidende) of the early opening of the electrolytic zinc smelter at Glamfjord. It has been under construction for some time. It will be the first of its kind in Norway, and it is supposed its opening will greatly stimulate the development of new mines and increased production of the old workings.

W. B. Stout to Build Metal 'Planes for Navy

William B. Stout, technical adviser to the aircraft board during the war and former chief engineer of the aircraft division of the Packard Motor Car Company, has been awarded a contract by the United States Navy Department for six all-metal airplanes of a type never before attempted in this country.

The action of the government is said to have been hastened by the successful performances in America of the German Junkers model, similar to the one designed by Stout and which made a non-stop flight from Omaha to Philadelphia.

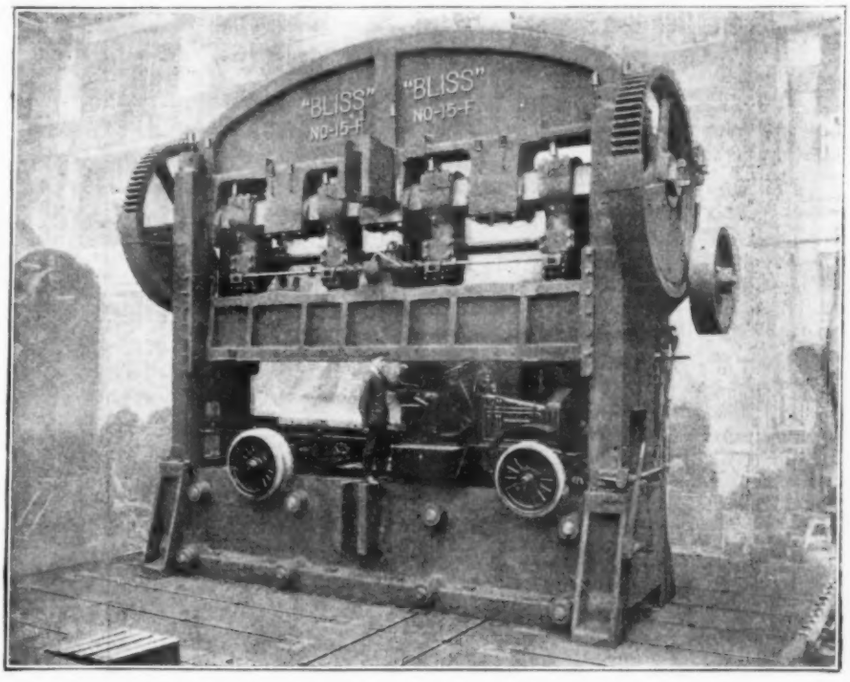
The capacity of the 'planes ordered from the Stout Engineering Laboratories has not been announced. The German airplane carries six passengers. Like the German 'plane the Stout type will dispense with the external bracing.

Stockholders of Bliss & Co. to Consider Recapitalization

Directors of E. W. Bliss & Co. have called a special meeting of stockholders for Aug. 11 to express approval or disapproval of a plan providing for the recapitalization of the company's finances. The purpose of the scheme is to enable the company to carry out a contract for the purchase of substantially all the plant and machinery of the Cleveland Machine and Manufacturing Co., of Cleveland, and also the plant of the Buckeye Engine Co., of Salem, Ohio.

Stockholders will be asked to approve the issuance of 300,000 shares of common stock, without par value and without voting rights. Also to authorize the issuance of 30,000 shares of first preferred stock, par $50, such stock to have the same rating as the present $1,500,000 cumulative preferred stock.

E. W. Bliss Co. Completes New Monster Press



The huge press shown in the illustration is a recent addition to the line of the E. W. Bliss Co., of Brooklyn, N. Y. It is a No. 15-F model, four-crank press, twin driven and triple geared, the gears being of steel. The primary use to which this press will be put by its purchaser is the blanking and perforating of side rails for the largest sizes of automobile truck frames. It can, of course, be used for other purposes and even for forming operations.

The Pierce-Arrow truck chassis shown in the photograph was placed in the press merely for the purpose of giving some comparison of sizes.

The important dimensions of the press are: Area of bed, 252 x 48 in.; area of slide face, 242 x 40 in.; number of strokes per minute, 5; total height, 25 ft. 9 in.

Personals

C. B. DURHAM, works manager of the Buick Motor Co., is to be assistant to the general manager in Chicago. Mr. Durham has been with the Buick organization since 1909 as assistant superintendent and was made works manager a year ago.

J. D. MOONEY has been appointed assistant to O. F. Conklin, general manager of the Remy Electric plant at Anderson, Ind. Mr. Mooney recently returned from England after assisting in organizing the Remy-Delco, Ltd.

W. H. MILLER, sales manager for the Pratt & Whitney Co., Hartford, Conn., completed thirty years of service with this company on Tuesday, July 29.

HARRY H. MARSALES has been appointed general traffic manager of the various plants of the Wickwire-Spencer Steel Corporation. Mr. Marsales' headquarters will be at the Buffalo plant.

H. L. SCHMEIDER, superintendent of the Advance Tool Co., Cincinnati, Ohio, has resigned. Hereafter, he will represent the Langhaar Ball Bearing Co., in Milwaukee and vicinity.

W. W. CLARK, export manager of the Hart-Parr Co., Charles City, Iowa, left this week for a three months' trip to the Far East in the interests of the Hart-Parr tractor. Mr. Clark will visit the Island of Formosa, Japan, Hong Kong, the Malay Islands and return by way of the Hawaiian Islands. He will also spend some time in the Philippine Islands.

L. H. BLOOD has recently resigned as chief engineer of the Oesterlein Machine Co., Cincinnati, Ohio, and has opened an office in the Union Central Building, Cincinnati, Ohio. Mr. Blood will specialize on the design of standard and special machine tools.

ALBERT D. WILEY, JR., in the credit department of the Norton Co., of Worcester, Mass., has been promoted to the Detroit store of the company, in charge of the credit department. Mr. Wiley will commence on his new duties Aug. 1.

ALBERT WALTON, of Philadelphia, has been made general works manager of Bateman & Co., Inc., of Delaware. Mr. Walton will be located at the general headquarters in New York City.

WILLIAM H. VOCKELL has resigned as tool engineer of the Cincinnati Milling Machine Co. and has organized the Cincinnati Engineering Tool Co., Cincinnati, of which he will be president.

H. C. UIHLEIN has resigned from the tool engineering department of the Cincinnati Milling Machine Co. to become secretary and treasurer of the Cincinnati Engineering Tool Co., Cincinnati, Ohio.

Trade Catalogs

Steel Products. Moltrup Steel Products Co., Beaver Falls, Pa. Catalog No. 1, pp. 95, 5¼ x 7¾ in. This is the first general catalog that the Moltrup Steel Products Co. has published and in it is presented descriptions and illustrations of its various products such as cold drawn steel in rounds, squares, etc.; shafting, screw stock, and special polished rod; turned and polished shafting; machine keys, woodruff keys and machine rack; flattened steel plates for various uses. It also contains tables of weights of circular plates; weights of aluminum sheets, decimal equivalents, metric conversion and others.

Precision Test Indicator. Deming Indicator Co., Dayton, Ohio. A single page circular illustrating and describing the Deming precision test indicator. Price list of parts is also given.

Air Compressors. Pennsylvania Pump and Compressor Co., Easton, Pa. Bulletin No. 100, pp. 12, 6 x 9 in. This bulletin describes a type of ring-plate valve, and an oil float gage for determining at all times, the level of oil in the crank basin.

Battery Charger. Hobart Bros. Co., Troy, Ohio. The Hobart Bros. Co. has issued two circulars describing a ten-battery charging outfit for use in garages.

Radiograph. Davis-Bournonville Co., Jersey City, N. J. Bulletin, 8½ x 11 in. This bulletin briefly describes the Davis-Bournonvill Radiograph No. 1 A and gives illustrations of the radiograph cutting steel plate and billets in fabricating plants, steel mills, boiler shops, bridge works, locomotive and car shops, with the oxy-acetylene and oxy-hydrogen torch.

Forthcoming Meetings

The International Railway Master Blacksmiths' Association will hold its next annual convention at Tutwiler Hotel, Birmingham, Ala., on Aug. 17, 18 and 19. The secretary of the association is A. L. Woodworth, Lima, Ohio.

The National Gas Engine Association, Monadnock Bldg., Chicago, Ill., will hold its thirteenth annual convention at the Congress Hotel, Chicago, on Sept. 1, 2 and 3.

The American Steel Treaters' Society and the Steel Treating Research Society will hold their second annual convention and exhibition at the Commercial Museum, Philadelphia, Pa., on Sept. 14 to 18, inclusive. J. A. Pollack, of the Pollak Steel Co., Cincinnati, Ohio, is secretary of the former society.

The American Foundrymen's Association will hold its annual convention and exhibit at Columbus, Ohio, on Oct. 4 to 9. C. E. Hoyt, 1401 Harris Trust Building, Chicago, Ill., is secretary.

An exposition of U. S. manufacturers at Buenos Aires, Argentine Republic, S. A., has been arranged for the month beginning Nov. 15. Information can be obtained from the American National Exhibition, Inc., Bush Terminal Sales Building, 132 West 42nd St., New York.

HARRIS E. WHITING has been made factory manager of Edward R. Ladew Co., Inc., Glen Cove, L. I., a subsidiary of Graton & Knight Manufacturing Co., of Worcester, Mass., at which plant he was formerly located. Mr. Whiting is now at the Ladew plant.

W. D. CREIDER, formerly Cleveland representative of the Modern Tool Co., has resigned his position and will represent the combined interests of the Reed-Prentice Co., the Becker Milling Machine Co., and the Whitcomb-Blaisdell Machine Tool Co. at the new Chicago office which they are opening.

Business Items

The Bethlehem Steel Corporation directors at their meeting recently declared the regular quarterly dividend of 1¼ per cent on both classes of common stock. President Grace reported the steel plants of the corporation operating at about 80 per cent capacity, with new business being booked at a rate equal to production. The shipbuilding plants have sufficient work on hand to assure full operations for balance of year, but there is no large volume of new business offering. The rate of operations is entirely controlled by the car supply, both for incoming and raw materials and for shipment of finished products. The corporation is providing itself with sufficient coal car equipment to protect the operation of its coal and steel properties.

Back from a trip abroad Peter S. Steenstrup, general manager of the General Motors Export Co., saw things that made him pleased with his journey. Europe, he says, is fast improving as a market for cars, but he found little to make him believe that foreign plants will soon be in a position to fill all the demands of the European trade.

It is announced that James L. Gough, president of the Federal Machinery Sales Co. of Chicago, with branches in Detroit and Milwaukee, has resigned as president and, having sold his interest in the concern, has withdrawn from any participation in its affairs. The business of the Federal Machinery Sales Co. will continue to be conducted along its established lines, no further change either in policy or personnel being contemplated.

The Sanford Riley Stoker Co., Ltd., of Worcester, Mass., has removed its offices to its new factory at 9 Neponset St. The new quarters give much additional space.

To take over the properties in Georgia and Alabama of the Bass Foundry and Machine Co., of Fort Wayne, Ind., the Rock Run Co., of Rock Run, Ala., has been chartered and incorporated under the laws of Alabama with a capital stock of $500,000. It will also operate the Rock Run furnace. Officers of the new corporation are: J. H. Bass, president; C. T. Strawbridge, vice president; G. M. Lesliem, treasurer, and L. H. Link, secretary, all of Fort Wayne, and J. M. Garvin, of Rock Run, vice president and general manager.

The associated interests of the Reed-Prentice Co., Becker Milling Machine Co. and Whitcomb-Blaisdell Machine Tool Co. are opening a new Chicago office and showrooms at 26 and 28 North Clinton St., Chicago. This new store is in the district known as Machinery Row, and is central with all the other machine-tool interests.

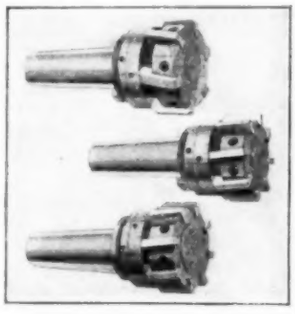
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Optical Equipment, Van Keure..
Van Keuren Co., 1706 Commonwealth Ave., Boston, Mass.
"American Machinist," July 22, 1920

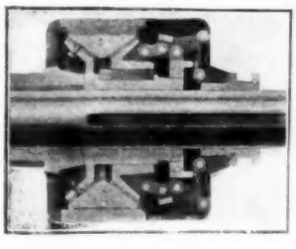
The equipment comprises **two** working optical flats, **one** master flat and one source **of** monochromatic light. Comparisons can be made in units of one-half wave length of light, which for daylight is approximately 0.00001 in. As it is easy to estimate with the eye one-tenth of the width of an interference band, the difference of 0.000001 in. may be seen. Any one of the three optical flats may be used for flatness tests, though only two are required for comparison of length. However, all the flats have one accurate surface and can be used to test each other by the method ordinarily used in originating surface plates. It is claimed that the accuracy of the working flats is within 0.000005 in. and that of the master flat is within 0.0000025 in.

Reaming Sets, Cylinder
Wetmore Reamer Co., Milwaukee, Wis.
"American Machinist," July 22, 1920



The reamers are made in sets of three, consisting of a roughing reamer, semi-finishing, and finishing reamer. They are furnished with arbors to fit all makes of machines. The roughing reamer blades are set at a right-hand cutting angle and are held in place by a head lock-nut and jam-nut of heat treated alloy-steel. The semifinishing reamer has blades with a left-hand cutting angle. The finishing reamer is of the floating design, with blades set at a left-hand cutting angle, and unequally spaced. The floating device is an improved Oldham float having rollers, and is thoroughly protected from dust and grit. All cutting blades are made of high-speed steel.

Clutch, "Twyncone" Friction
Link-Belt Co., Chicago, Ill.
"American Machinist," July 22, 1920



This clutch embodies the following features: One point adjustment; perfect balance and complete inclosure of all moving parts. Very high speed may be attained without causing "throw in" or "throw out" and the clutch can be engaged or disengaged when running at any speed. The friction cones are lined with thermoid.

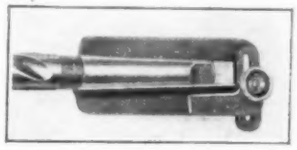
Press, Verson, No. 0 Inclinable Power Bench
La Salle Machine Works, 3013 South La Salle Street, Chicago, Ill.
"American Machinist," July 22, 1920

This machine is adapted for use on small parts where speed and accuracy are required. It is provided with a hardened tool steel clutch with the addition of an automatic safety device which disengages at each revolution of the press, even without the release of the treadle. The machine is of the open-back type and can be furnished with a table and legs if desired. Specifications: Stroke, 1 in. Adjustment of slide, 1 in. Bed to slide, with stroke down and adjustment up, 5 in. Area top of bolster, 6 x 8 in. Thickness of bolster, $\frac{3}{4}$ in. Width of opening through back, 4 in. Height, bench to center of shaft, 21 in. Flywheel, 12 in. diameter, by $2\frac{1}{2}$ in. face; speed, 225 r.p.m. Hole in bed, 3 x $3\frac{1}{2}$ in.

Measuring Machine, Microscopic
Alfred Herbert, Ltd., 54 Dey St., New York City.
"American Machinist," July 22, 1920

The machine has a table capable of 12-in. longitudinal movement by accurate amounts by insertion and removal of hardened steel measuring rods between flat contact pieces. The table carries a pair of centers, one of which can be adjusted crosswise to enable accurate alignment of work. A microscope fitted with two crosshairs, one rotating with the outside tube and the other rotating with the eyepiece, is mounted on a compound slide controlled by micrometer screws. The outer tube of the microscope has a dial reading to half degrees and the eyepiece has a vernier reading to one minute of arc. A light projector is fixed to the machine and will project parallel rays of light through a lens upon a mirror and past the work.

Gage, Knaeul Adjustable Taper
Knaeul Tool Works, 1544 Twenty-four and One-half Street, Rock Island, Ill.
"American Machinist," July 22, 1920

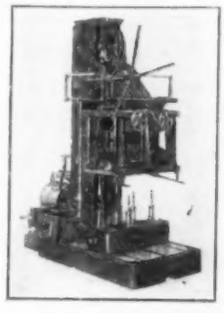


This device can be quickly adjusted and locked in position on **any taper for duplicating** work. In use, the piece to be duplicated is laid in the lower V and the top piece brought down until light is excluded. The gage is then locked in position. The gage is made in only one size and will cover the ordinary range of tapers up to No. 11 Brown and Sharpe or No 4 Morse.

Center, Etteo Insert
The Eastern Tube and Tool Co., 594 Johnson Ave., Brooklyn, N. Y.
"American Machinist," July 22, 1920

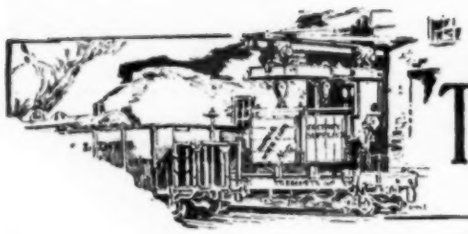
The threaded points are made of high-speed steel ground to size and are interchangeable. The shanks are made of carbon steel, hardened and ground, and are furnished in all standard sizes and tapers.

Drilling Machine, Natco No. 85 Inverted
National Automatic Tool Co., Richmond, Ind.
"American Machinist," July 22, 1920



The machine is used to advantage for deep hole drilling in cast iron as there is no accumulation of chips in the holes to interfere with the drill so that it is not necessary to back out the drills at frequent intervals to remove the chips. The machine, as shown, is arranged to drill five $\frac{7}{8}$-in. holes at one time to a depth of $4\frac{3}{4}$ in. The work is held in a special fixture supported from the table which feeds downward. When placed in position the work is securely locked by means of two handwheels. The drill spindles are adjustable for position and the bearings are amply protected against dust and chips.

Clip, paste on 3 x 5-in. cards and file as desired



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	Current	One Year Ago
No. 2 Southern	$45.60	$29.80
Northern Basic	42.80	27.55
Southern Ohio No. 2	46.80	28.55
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	49.65	31.90
Southern No. 2 (Silicon 2.25 to 2.75)	49.70	33.95
BIRMINGHAM		
No. 2 Foundry	42.00@44.00	25.75
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25–2.75 sil.	46@48.25*	30.65
Virginia No. 2	45.00*	30.85
Basic	44.50†	29.90
Grey Forge	43.50*	29.90
CHICAGO		
No. 2 Foundry local	44.25	27.25
No. 2 Foundry, Southern	47.00	31.75
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	45.65	28.15
Basic	44.40	27.15
Bessemer	41.90	29.35
MONTREAL		
Silicon 2.25 to 2.75%	43.25	.....

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.47	$3.97	$3.47	$5.00	$3.37	$3.97	$3.47
Soft steel bars	4.62	4.12	3.37	4.50	3.27	3.87	3.37
Soft steel bar shapes	4.62	4.12	3.37		3.27	3.87	3.37
Soft steel bands	6.32	5.32	4.07	6.25			
Plates, ¼ to 1 in. thick	4.67	4.17	3.67	4.50	3.57	4.17	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$2.62
Warehouse, New York	4.57	3.37
Warehouse, Cleveland	3.52	3.22
Warehouse, Chicago	3.75	3.37

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

	Large Mill Lots	New York			
Blue Annealed	Pittsburgh	Current	One Year Ago	Cleveland	Chicago
No. 10	3.55–7.00	7.12@8.00	4.57	8.10	7.02
No. 12	3.60–7.65	7.17@8.05	4.57	8.15	7.07
No. 14	3.65–7.10	7.22@8.10	4.67	8.20	7.12
No. 16	3.75–6.20	7.32@8.20	4.77	8.30	7.22
Black					
Nos. 18 and 20	4.20–6.20	7.80@9.50	5.30	8.70	7.80
Nos. 22 and 24	4.25–6.25	7.85@9.55	5.35	8.75	7.85
No. 26	4.30–6.30	7.90@9.60	5.40	8.80	7.90
No. 28	4.35–6.35	8.00@9.70	5.50	8.90	8.00
Galvanized					
No. 10	4.70–8.00	8.55@11.00	6.20	9.00	8.15
No. 12	4.80–8.10	8.65@11.00	6.25	9.10	8.20
No. 14	4.80–8.10	8.65@11.10	6.30	9.10	8.35
Nos. 18 and 20	5.10–8.40	8.90@11.40	6.60	9.40	8.65
Nos. 22 and 24	5.25–8.55	9.05@11.55	6.75	9.55	9.05
No. 26	5.40–8.70	9.20@11.70	6.90	9.70	9.20
No. 28	5.70–9.00	9.50@12.00	7.20	10.00	9.50

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled.

Automobile sheets are unavailable except in fugitive instances, when prices are 9.45c per lb. for No. 16; 9.50 for Nos. 18 and 20, and 9.55c for Nos. 22 and 24.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$6.25	$5.80	$6.00
Flats, square and hexagons, per 100 lb. base	6.75	6.30	6.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$20.00	$21.00–26.00
Cleveland	20.00	20.00
Chicago	21.00	16.50

In coils an advance of 50c. usually is charged.
Domestic iron (Swedish analysis) is selling at 12c. per lb.

WELDING MATERIAL (SWEDISH)—These prices are the best we have been able to obtain for Swedish welding materials, of which it is reported that very little are on the market.

Welding Wire		Cast-Iron Welding Rods	
5/32, 3/16, 7/32, 1/4, 9/32, 5/16, No. 8, 3/32 and No. 10	21.00 to 30.00	1/16 by 12 in. long	14.00
1/8		1/16 by 19 in. long	12.00
No. 12		3/16 by 19 in. long	10.00
5/32, No. 14 and 1/16		1/4 by 21 in. long	10.00
No. 18		Special Welding Wire, Coated	
No. 20		1/16	33.00
		5/32	30.00

Domestic Welding wire in 100-lb. lots sells as follows, f. o. b. New York: 5/32, 8½c. per lb.; 1/8, 8c.; 5/32 to 1/4, 7½c.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.00
Spring steel (light)	10.00	11.00	12.25
Coppered bessemer rods	9.00	8.00	6.75
Hoop steel	6.57	6.50	5.32
Cold-rolled strip steel	12.50	8.25	10.75
Floor plates	6.80	6.00	6.77

PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card, discounts on steel pipe, applying as from January 14, 1920, and on iron pipe from January 7, 1920.

BUTT WELD

Steel Inches	Steel Black	Steel Galvanized	Iron Inches	Iron Black	Iron Galvanized
¼ to 3	54–57½%	41½–44%	¼ to 1¼	24½–34½%	8 –18½%

LAP WELD

2	47 –50½%	34½–38%	1¼		
2½ to 6	50 –53½%	37½–41%	1½		
7 to 12	47 –50½%	33½–37%	2	20½–28½%	6½–14½%
13 to 14	37½–41 %		2½ to 6	22½–30½%	9½–17½%
15	35 –38½%		2½ to 4	22½–30½%	9½–17½%
			7 to 12	19½–27½%	6½–14½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

¼ to 1½	52 –55½%	39½–43%	¼ to 1½	24½–34½%	9½–19½%
2 to 3	53 –56½%	40½–44%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	45 –48½%	33½–37%	1¼		
2½ to 4	48 –51½%	36½–40%	1½		
4½ to 6	47 –50½%	35½–39%	2	21½–29½%	8½–16½%
7 to 8	43 –46½%	29½–33%	2½ to 4	23½–31½%	11½–19½%
9 to 12	38 –41½%	24½–28%	4½ to 6	22½–30½%	10½–18½%
			7 to 8	14½–22½%	2½–10½%
			9 to 12	9½–17½%	5½–+2½%

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
¼ to 3 in. steel butt welded	40%	24%	40%	31%	54%40%	40½@30 %
2½ to 6 in. steel lap welded	35%	20%	42%	27%	50@40%	37½@27½%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 32%. Cast iron, standard sizes, net.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	19.00	19.25	21.25
Tin in 5-ton lots	49.50	61.50	70.00
Lead	9.25	9.00	5.50
Zinc	8.25	8.70	8.00
ST. LOUIS			
Lead	8.90	8.87½	5.25
Zinc	7.90@8.40	8.37½	7.65

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

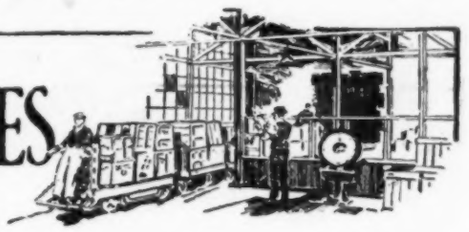
	New York			Cleveland		Chicago April 8	
	Current	Month Ago	Year Ago	Current	Year Ago	Current	Year Ago
Copper sheets, base	33.50	33.50	29.50	32.00	33.50	36.00	36.50
Copper wire (carload lots)	31.25	31.25	26.50	29.50	29.50	27.00	25.00
Brass sheets	28.50	28.50	23.00	29.00	29.00	27.00	28.00
Brass pipe	33.00	33.00	34.00	34.00	36.00	35.00	37.00
Solder (half and half) (case lots)	38.00	33.00	45.00	40.50	41.00	38.00	41.00

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	25.00	19.00
New York	27.00	21.50
Cleveland	27.00	30.00
Chicago	26.00	30.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound prevail:
Carload lots f.o.b. mill..... 12.50

	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.00	12.95	15.50	13.30
New York	14.00	12.00	14.50	13.00
Chicago	15.00	16.50	15.00	16.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	7.50	8.37½
Chicago	7.75	10.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	16.25	16.75	15.50	15.50
Copper, heavy, and wire	15.25-15.75	15.75	15.00	15.00
Copper, light, and bottoms	13.00	13.50	13.00	14.00
Lead, heavy	7.00	4.62½	7.00	7.00
Lead, tea	5.00	3.75	5.00	6.00
Brass, heavy	10.25	10.00	11.00	15.50
Brass, light	7.75-8.00	8.00	8.00	9.50
No. 1 yellow brass turnings	9.00-9.50	9.00	8.50	9.50
Zinc	5.25	4.25	4.50	9.50

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb.	33.00	34.00c.@35.00c.	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	38.00	25.00
Chicago	29.00	28.00
Cleveland	32.00	33.00

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	90.00	90.00	61.00	80.00	60.00	75.00
Commercial	50.00	50.50	21.00	18.50	15.00	15.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+ $6.00	$3.25	$ .50	$2.25	$.50	1.05
Hot pressed hexagon	+ 6.00	2.70	.50	2.25	.50	.85
Cold punched hexagon	+ 6.00	3.25	.50	2.25	.50	1.00
Cold punched square	+ 6.00	2.70	.50	2.25	.50	1.00

Semi-finished nuts, ⅝ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	50-10%
Chicago	50%	50%
Cleveland	50%	60-10-10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	+ 20%	20%	20%
Larger and longer up to 1½ in. by 30 in.	+ 20%	20%	10%

WASHERS—From warehouses at the places named the following amount is deducted from list price:
For wrought-iron washers:
New York..... list Cleveland..... $2.50 Chicago..... $3.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $7.00 Cleveland..... $4.50 Chicago..... $4.75

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+ 20%	35%	10%
Larger and longer up to 1 in. by 30 in.	+ 20%	20%	5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	20%	20%	10%	10%
Chicago	net	20%	net	20%
New York	25%	40%	net	20%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	List Net	40%	30%
Tinned	List Net	40%	30%

Boiler, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York..... $6.00 Chicago..... $5.62 Pittsburgh..... $4.50
Structural, same sizes:
New York..... $7.10 Chicago..... $5.72 Pittsburgh..... 4.60

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	34.00	34.00	35.00
Brass	33.00	34.00	34.00

The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1 c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities from 10-25 lb., extra is 10c.; less than 10 lb., add 15-20c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in. inclusive in rounds, and ¼-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $12.50 per 100 lbs.
In Cleveland—$10 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	New York		Cleveland	Chicago
	Current	One Year Ago		
White	15.00@17.00	13.00	16.00	11.00 to 14.00
Colored mixed	9.00@14.00	9.00-12.00	12.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.00	$3.00	$1.75
Philadelphia	2.75	2.75	1.75
Cleveland	3.00	2.50	2.75
Chicago	2.25	2.50	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.90	$3.90	$3.65
Philadelphia	3.65	3.65	3.62
Chicago	5.00	5.00	4.12½

COKE—The following are prices per net ton at ovens, Connellsville:

	July 8	July 1	June 24
Prompt furnace	$17.50@$18.50	$17.50@$18.50	$15.00@$16.00
Prompt foundry	18.00@19.00	18.00@19.00	16.00@17.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	New York		Chicago	
	Current	One Year Ago	Current	One Year Ago
Raw in barrels (5 bbl. lots)	$1.53	$2.15	$1.95	$2.53
5-gal. cans (without cans)	1.56*	2.28	2.15	2.73

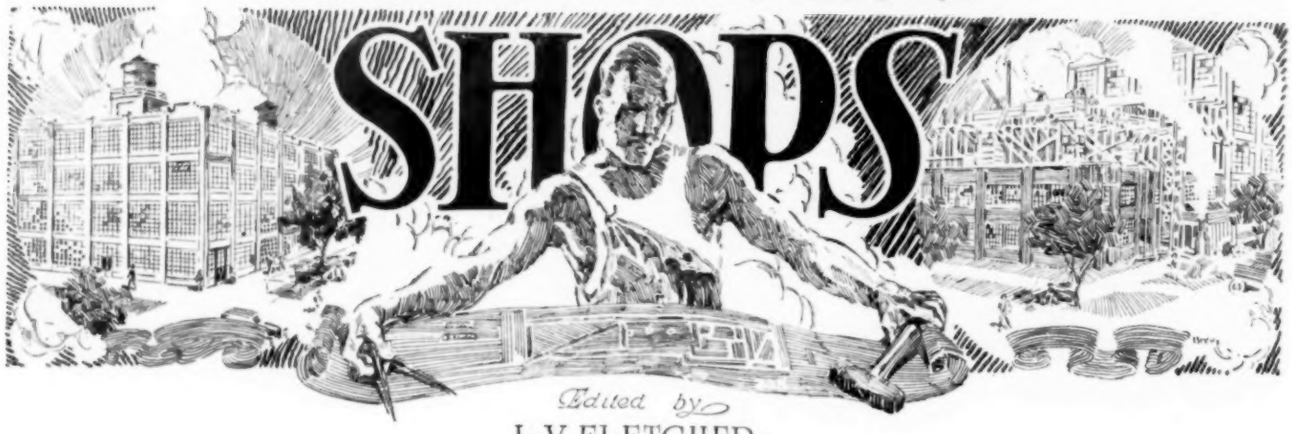
*To this *oil* price must be added the cost of the cans (returnable), which is $2.25 for a case of six.

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	15.50	17.00	13.00	14.50	15.50	13.00
25 and 50-lb. kegs	15.75	17.25	13.25	14.75	15.75	13.25
12½-lb. keg	16.00	17.50	13.50	15.00	16.00	13.50
5-lb. cans	18.50	20.00	15.00	16.50	18.50	15.00
1-lb. cans	20.50	22.00	16.00	17.50	20.50	16.00

500 lb. lots less 10% discount. 2000 lb. lots less 10-2½% discount.

NEW and ENLARGED



Edited by
L·V·FLETCHER

Machine Tools

The following concerns are in the market for machine tools:

Mass., Cambridge — The Acme Garage, Prospect and Hampshire Sts.—one arbor press, one drill and one emery wheel.

Mass., New Bedford—Manomet Mills, A. Valentine, Master Mechanic.
Two 14 in. lathes with 7 ft. bed.
One 24 in. lathe with 12 ft. bed.
One miller.
One power hacksaw.
One vertical drill.
One floor drill.
One bolt machine.
One drill grinder.
Two speed lathes.
One patternmaker's lathe.
One electric grinder.
One band saw.
One table saw.
One planer and jointer.
Blacksmith shop and welding equipment.

Mass., Springfield—Freedman & Glazier, 68 Ferry St.—repair shop equipment.

Mass., Worcester—J. E. Snyder & Sons, Dewey and Parker Sts.—heavy duty boring mills similar to No. 2 Coburn.

N. J., Newark—Donner & Co., Polk St.—one automatic grinding machine with 32 in. bed.

N. J., Paterson—The Wright Aeronautical Corp.—machine tool equipment.

N. Y., New York (Borough of Brooklyn)—The I. H. Dexter Co., 27 Walker St.—machine tools for Goshen factory.

N. Y., New York (Borough of Manhattan)—The Milholland Co., 111 Bway.—one No. 35 Toledo press.

N. Y., New York (Borough of Manhattan)—The Trojan Tool Corp., 511 West 42d St.—several automatic screw machines.

Pa., Connellsville — The Yough Electric Repair Co.—equipment for manufacture of coils and dies or pulling copper.

Pa., Philadelphia—The Blumenthal Bros., Margaret and James Sts.—machine shop equipment.

Pa., Philadelphia — The Pennsylvania Screw and Machine Wks., 712 Cherry St.—Brown & Sharpe screw machines.

Pa., Philadelphia—G. E. Recklitz, 1238 North 3d St.—one 12 in. x 6 ft. tool room lathe.

D. C., Washington—A. L. Flint, Purch. Agt. for the Panama Canal—one planer, one press, one shear and one hoist.

Ky., Louisville — The Haller Troutman Bros. Motors Co., 2613 Cave Run Rd.—machine shop equipment.

N. C., Wilmington—The G. A. Fuller Co., Carolina Shipyard—two motor driven pipe machines, capacity ¼ to 2 in.

Va., Ashland—The Ashland Garage—garage equipment.

Ill., Chicago — The Atchison, Topeka & Santa Fe. Ry., Ry. Exch. Bldg., M. J. Collins, Purch. Agt.—
One 2¼ x 36 in. heavy duty turret lathe.
One 24 in. heavy duty sensitive drill press, alternative with tapping attachment, alternative with back gears.
One 36 in. heavy duty double head shaping machine with 14 ft. head.
Quotations desired on belt drive and also on 440 v., 3 ph., 60 cycle motor drive on each of above.

Ill., Chicago—The Barrett-Crane Co., 169 North Ann St.—one 16 in. crank shaper.

Ill., Chicago—The Chrobaltic Tool Co., Ry. Exch. Bldg.—one small shear for shearing rounds up to ¾ in. diameter.

Ill., Chicago—Kinsley Bros., Inc., 2799 South Wells St.—
One squaring shear for ⅜ in. stock, 96 in. long.
One gantry transfer crane.
One radial drill.
One die surface grinder.
One drill grinder.

Ill., Chicago—The Precision Eng. Wks., 838 North Wells St.—one 20 in. shaper.

Ill., Chicago—The Rock Island Lines, 179 West Jackson Bl., F. D. Reed, Purch. Agt.—For delivery to Trenton, Mo.—
One Oster power pipe and nipple threading machine with right-hand dies from 1 to 4 in.
One set of nipple jaws for above.
For delivery to Inver Grov, Minn.—
One 36 in. x 12 in. engine lathe with 3 step cone pulley, double back quick change gears.

Ill., Chicago — The Up-to-Date Machine Wks., 2915 South Wabash Ave.—automatic screw machine.

Ill., Chicago—R. Woods, 1438 1st Natl. Bank Bldg.—power gap shears.

Ind., Indianapolis — The Pioneer Brass Wks., 424 South Pennsylvania St.—$200,000 worth of equipment, including lathes, etc.

Mich., Detroit—The Bd. of Water Comrs., 232 Jefferson Ave.—repair shop equipment.

Mich., Detroit—The Cost Cut Counterbore Co., 74-78 Fort St., D. Greenspon, Mgr.—miscellaneous equipment for machining counterbore tools.

Mich., Detroit—The Square D Co., 1400 Rivard St.—one large size squaring shear for 36 in. stock or larger.

O., Cleveland—The Aetna Brass Mfg. Co., 1635 East 55th St.—one screw machine of 1 in. capacity, equivalent of No. 2 Warner & Swasey and one punch press similar to No. 4 Consolidated or No. 20 Cliff.

O., Cleveland—The J. R. Gloyd Co., 1816 East 33d St.—one lathe, 3 ft. between centers (used).

Wis., Beloit—The C. H. Besly Co.—two No. 2¾ old style, Pratt & Whitney hand screw machines with counter shafts; one screw machine with spring collet, capacity up to 2¼ in rounds (used).

Wis., Milwaukee—The Amer. Valve Rotator Co., 917 Chestnut St., H. Davischefsky, Purch. Agt.—heavy punch presses.

Wis., Milwaukee—The Magnetic Mfg. Co., 764 Windlake Ave., E. Bethke, Purch. Agt.—one 30 in. radial drill.

Wis., Milwaukee—J. C. Nelson, 857 27th St.—drill presses and five 18 to 30 in. lathes.

Wis., Milwaukee—A. J. Uchitil, 656 Madison St.—one polishing lathe with 2 in. shaft.

Wis., Sheboygan—The Wald Mfg. Co.—one grinder to sharpen 72 in. squaring shear knife.

Minn., Winona—The Winona Wagon Co.—one bolt heading machine to head king bolts up to 1¼ in. diameter.

Utah, Salt Lake City—The Builders Steel and Iron Co., 625 South 4th St., W.—one single end punch, capacity ⅞ in hole in ⅞ in. stock, belt or motor drive (new or used).

Ont., Toronto—The Coleman Lamp Co.—machine tool equipment.

Machinery

The following concerns are in the market for machinery:

Md., Baltimore—E. H. Koester, 648 West Lexington St.—$75,000 worth of bakery equipment.

N. Y., New York (Borough of Manhattan)—The Yukon Gold Co., 120 Bway.—one 8 ton hand power crane.

Pa., Beaver Falls — The Beaver Falls Planing Mills Co.—woodworking machinery, including molder, sander, router and cabinet planer (new or used).

Pa., Essington—The Westinghouse Electric Co.—foundry equipment.

Pa., Philadelphia—The Berger Mfg. Co., 16th and Washington Sts.—one power saw table.

Va., Richmond—The Solomon Bakery Co., Inc., 3819 Williamsburg Ave., J. N. Solomon, Purch. Agt.—bakery equipment.

Va., Richmond—The Standard Paper Co., Canal and Hull Sts., J. T. Ryland, Treas. and Secy.—$300,000 worth of machinery for the manufacture of paper.

Ill., Chicago — The International Harvester Co., 606 South Michigan Ave.—one vertical gang piston turning machine.

Ill., Chicago—The Standard Electric Mfg. Co., 216 North Clinton St.—machinery for manufacture of electric switches.

Ill., Chicago—The Victor Chemical Wks., Fisher Bldg.—one No. 201 Reliance swing saw with 14 in. blade.

Mich., Benton Harbor—The Benton Harbor Malleable Fdry. Co.—equipment for annealing room and foundry.

Mich., Detroit — The Hayes Mchy. Co., East Larned St., A. Sprague, Secy.—power and board drop hammers (used).

Mich., Hancock — A. J. Verville — woodworking machinery.

Mich., Traverse City—The Traverse City Cigar Box Co., Boardman Ave. and East High St.—equipment for the manufacture of cigar boxes.

O., Akron—The Akron Gear and Eng. Co., South and High Sts.—miscellaneous machinery for new plant.

O., Canton—The Timken Roller Bearing Co., Denber Ave.—miscellaneous equipment for new plant.

O., Cincinnati — The Lippincott Co., 42 Main St.—$50,000 worth of machinery for canning plant at Boonville, Ind.

O., Columbus — The Jeffrey Mfg. Co., North 4th St.—six cranes, one 50 ton, three 25 ton, and two 5 ton.

Wis., Milwaukee—The F. E. Abeles Co., 518 Prairie St.—one stenciling machine.

Wis., Milwaukee—The Evinrude Motor Co., 279 Walker St., C. J. Meyer, Purch. Agt.—one monorail crane.

Wis., Milwaukee—The H. W. Johns-Manville Co., 201 Clybourn St.—portable clamshell crane.

Wis., Milwaukee—M. Mueller, 109 Grand Ave.—vulcanizing outfit.

Wis., Milwaukee — The Tomah Rubber Wks., 176 16th St.—rubber working machinery for Sheboygan factory.

Ont., Alviston—McEachern & Son—equipment for planing mills.

Ont., Cobalt—The Moose Lake Lumber Co.—machinery for sawmill.

Ont., Goderich — The Natl. Shipbuilding Co., W. H. Hutchinson, Mgr.—machinery for the manufacture of flax.

Ont., Listowel—The Perfect Knit Mills—knitting machinery and special machinery for the manufacture of cloth.

Que., Thetford Mines—A. Lemieux—complete equipment for sawmill and planing mill.

Metal Working

NEW ENGLAND STATES

Conn., Bridgeport—A. Aldo, 1699 Madison Ave., is having plans prepared by F. A. Cooper, Archt., 1024 Main St., for the construction of a 1 story, 100 x 110 ft. garage on North Ave. Estimated cost, $50,000.

Conn., Bridgeport—The Amer. Tube and Stamping Co., 471 Hancock Ave., will build a 1 story, 50 x 160 ft. annealing building on Wordin Ave. Estimated cost, $30,000.

Conn., Waterbury—M. J. Daly & Sons, 543 Bank St., has awarded the contract for the construction of a 1 and 3 story addition to its plant for the manufacture of sheet metal, etc. Estimated cost, $85,000. Noted July 8.

Conn., Waterville—The Berbecker & Rowland Mfg. Co., Main St., has awarded the contract for the construction of a 3 story, 40 x 180 ft. factory on Main St., for the manufacture of metal goods. Estimated cost, $100,000.

Mass., Cambridge—G. Lawrence, Inc., 24 Cambria St., is having plans prepared by W. T. Littlefield archt., 9 Hamilton Pl., Boston, for the construction of a 1 story addition to its plant for the manufacture of automobile springs.

Mass., Holyoke—The Elm Garage Co., 243 Elm St., plans to build a 2 story garage on Elm and Cabot Sts. Estimated cost, $65,000.

Mass., Holyoke—The Magna Automobile Co., 354 South Broad St., has awarded the contract for the construction of a 2 story, 90 x 100 ft. garage on Northampton St. Estimated cost, $75,000. Noted Jan. 15.

Mass., Lawrence — W. H. Currier, 155 Salem St., is preparing plans for the construction of a 1 story garage on Salem St. Estimated cost, $10,000.

Mass., Lawrence—C. W. Dillon, 17 Oxford St., is preparing plans for the construction of a 1 story addition to his garage. Estimated cost, $10,000.

Mass., Springfield—Freedman & Glazier, 68 Ferry St., will build a 1 story garage and repair shop on North St. Estimated cost, $20,000.

Mass., Watertown—The Walker & Pratt Mfg. Co., 31 Union St., Boston, has awarded the contract for the construction of a 1 story, 200 x 230 ft. addition to its plant, for the manufacture of stoves. Estimated cost, $200,000. Noted July 22.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Miller Safe Co., Fremont Ave. and Briscoe St., has awarded the contract for the construction of a 1 and 2 story, 123 x 400 ft. factory on Wilkins Ave. and Katherine St. Estimated cost, $1,000,000. Noted July 15.

N. J., East Orange — The Rich Garage Co., 393 North Arlington St., has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage at 362 William St. Estimated cost, $15,000.

N. J., Trenton—The Castanea Dairy Co., North Broad St., is having plans prepared by W. A. Klemann, archt., 1st Natl. Bank, for the construction of a 2 story, 50 x 50 ft. garage on Feeder St. Estimated cost, $18,000.

N. J., Trenton — The Neidt Ertel Motor Co., 354 South Broad St., has awarded the contract for the construction of a 1 story, 60 x 181 ft. garage and machine shop on South Broad St. Estimated cost, $50,000. Noted March 4.

N. Y., Buffalo—The L & R Steel Co., 368 Main St., has had plans prepared for altering the first floor of its factory. Estimated cost, $5,000.

N. Y., Buffalo — The O'Neill Iron Wks., 268 Perry St., has awarded the contract for the construction of a 2 story, 23 x 28 ft. addition to its plant. Estimated cost, $15,000.

N. Y., Buffalo—The Parenti Motors Corp., 1760 Main St., has awarded the contract for the construction of a 1 story, 100 x 350 ft. factory at 616-32 Northumberland St., for the manufacture of automobiles. Estimated cost, $100,000. Noted July 22.

Pa., Connellsville — The Yough Electric Repair Co. is building a 132 x 198 ft. shop. Estimated cost, $20,000.

Pa., Essington—The Westinghouse Electric Co. has awarded the contract for the construction of a 1 story, 120 x 200 ft. foundry at its plant.

Pa., Philadelphia—The Brown Instrument Co., Windrim and Wayne Sts., manufacturer of pyrometers and steam gages, has awarded the contract for altering its factory. Estimated cost, $20,000.

Pa., Philadelphia—The Blumenthal Bros., Margaret and James Sts., will soon award the contract for the construction of a 1 story, 60 x 100 ft. garage and machine shop. Estimated cost, $20,000.

Pa., Wilkes-Barre — The Durkin Bros., Parrish St., will soon award the contract for the construction of a 1 story, 44 x 100 ft. garage on East South St. Estimated cost, $30,000. F. B. R. Sahur, Washington St., Archt.

SOUTHERN STATES

Ala., Birmingham—The Amer. Bolt Wks., 39th St. and 10th Ave., N., has awarded the contract for the construction of an addition to its forge shop. Estimated cost, $25,000.

MIDDLE WEST

Ill., Chicago—The Standard Electric Mfg. Co., 216 North Clinton St., plans to build a 2 or 5 story, 125 x 150 ft. factory on Wrightwood Ave., for the manufacture of electric switches. Estimated cost, $250,000.

Ind., East Chicago—The Carroll Castings Co., which has recently been incorporated with $250,000 capital stock, has purchased a site along the tracks of the Indiana Harber Belt Ry., and plans to build a plant for the manufacture of small grey iron castings.

Ind., Indianapolis — The Pioneer Brass Wks., 424 South Pennsylvania St., is building a plant.

Ind., Kokomo—The Haynes Automobile Co., 1108 South Main St., has awarded the contract for the construction of a 1 and 2 story, 75 x 200 ft. plant for the manufacture of automobile bodies. Estimated cost, $250,000.

Ind., West Hammond—The LaSalle Iron Wks., 2305 South Halsted St., Chicago, Ill., has awarded the contract for the construction of a 1 story steel plant to consist of a 210 x 560 ft. main building and 6 additional buildings. Estimated cost, including equipment, $650,000. Noted July 1.

Mich., Detroit—The Bd. of Water Comrs., 232 Jefferson Ave., has awarded the contract for the construction of a 1 story, 99 x 120 ft. machine shop. Noted June 10.

Mich., Detroit—The Michigan Grey Iron Casting Co., Harbaugh Ave., has awarded the contract for the construction of a 1 story addition to its foundry on Harbaugh Ave. along the tracks of the Wabash R.R. Estimated cost, $40,000.

O., Akron—The Akron Gear and Eng. Co., South and High Sts., has purchased a site on East Market St. and Martha Ave., and plans to build a plant. J. A. Palmer, Pres.

O., Canton—The Timken Roller Bearing Co., Dueber Ave., plans to build a 1½ story addition to its plant on 18th St., S.W. Estimated cost, $75,000.

O., Cleveland—Brennan & McBride, 6715 Carnegie Ave., has awarded the contract for the construction of a 1 story, 50 x 92 ft. machine shop addition at 6924 Carnegie Ave. Estimated cost, $30,000.

O., Cleveland—The Cooperative Stove Co., 2323 East 67th St., has awarded the contract for the construction of a 1 story, 40 x 80 ft. addition to its factory. Estimated cost, $10,000.

O., Cleveland—E. Drocz, 8616 Buckeye Rd., has awarded the contract for the construction of a 1 story, 50 x 60 ft. garage. Estimated cost, $10,000.

O., Cleveland—The Ideal Motor Car Co., 4427 Pearl Rd., has awarded the contract for the construction of a 2 story, 30 x 48 ft. garage at 4459 Pearl Rd. Estimated cost, $20,000.

O., Cleveland—The Jordan Motor Car Co., 4052 East 152nd St., has awarded the contract for the construction of a 2 story factory at 1070 East 152nd St. Estimated cost, $100,000.

O., Cleveland—The J. Laronge Co., 214 Williamson Bldg., has awarded the contract for the construction of a 1 story, 50 x 120 ft. garage on East 16th St. and St. Clair Ave. Estimated cost, $75,000. Noted July 29.

O., Cleveland—The Vcela Building and Loan Co., 5703 Bway., has awarded the contract for the construction of a 1 story, 18 x 63 ft. garage. Estimated cost, $10,000.

O., Columbus — The Jeffrey Mfg. Co., North 4th St., has awarded the contract for the construction of a 60 x 215 x 277 ft. factory for the manufacture of coal mining and conveying machinery. Estimated cost, $500,000.

O., Fostoria—The Willys Light Corp., 221 Cherry St., Toledo, is building a 1 story, 120 x 241 ft. foundry for the manufacture of iron castings. Estimated cost, $125,000.

Wis., Kenosha—The Greiner Nash Co., 266 Wisconsin St., plans to build a 1 story, 80 x 162 ft. garage and repair shop on Chicago St.

Wis., Milwaukee—S. Buchbinder, 545 Van Buren St., will soon award the contract for the construction of a 1 story, 65 x 70 ft. garage on Marshall St. Estimated cost, $15,000.

Wis., Milwaukee—The Eslein Sheet Metal Wks., 1001 30th St., will build a 1 story, 30 x 120 ft. addition to its sheet metal plant. Estimated cost, $8,000.

Wis., Milwaukee—The General Welding and Mfg. Co., 347 Florida St., will soon award the contract for the construction of a 1 story, 30 x 35 ft. addition to its factory. Estimated cost, $8,000.

Wis., Milwaukee—The Ramstack & Son Mfg. Co., 1826 Brown St., is preparing plans for the construction of a 2 story, 60 x 100 ft. addition to its factory for the manufacture of spark plugs.

Wis., Oconomowoc—R. Welch is preparing plans for the construction of a 1 story, 60 x 60 ft. garage. Estimated cost, $12,000.

Wis., Waukesha—The Waukesha Casting Co., Lincoln Ave., has awarded the steel contract for the construction of a 120 x 130 ft. foundry. Estimated cost, $50,000. Noted July 15.

WEST OF THE MISSISSIPPI

Ia., Des Moines—The Mid West Steel Co. plans to build a 2 story plant. Estimated cost, $200,000. J. Van Lew, Pres.

Ia., Dubuque—The Adams Co., 295 6th St., is building a 3 story foundry.

Ia., Newton—The Newton Fdry. Co. has awarded the contract for the construction of a 2 story, 106 x 300 ft. foundry. Estimated cost, $100,000.

Mo., St. Louis—The City has awarded the contract for the construction of a garage at the city hospital. Cost, $19,973.

Mo., St. Louis—The Trione Piston Ring Co., Pierce Bldg., St. Louis, has awarded the contract for the construction of a 1 story, 56 x 93 ft. factory on Forrest Park Blvd. Estimated cost, $20,000.

Tex., San Antonio—E. Rand, 515 Belknap St., is building a 1 story, 50 x 120 ft. garage on Goledad St. Estimated cost, $37,000.

Tex., San Antonio—Taylor & Holder are building a 1 story, 40 x 100 ft. garage on Travis St. Estimated cost, $22,000.

CANADA

N. B., St. Stephen—The Mann Axe and Tool Co. plans to build a 1 story, 50 x 360 ft. plant, to replace the one which was recently destroyed by fire. C. E. Huestis, Genl. Mgr.

Ont., Brantford—The Cockshut Plow Co. will soon award the contract for the construction of a 70 x 200 ft. foundry and forging building for the manufacture of sleighs and trucks. Estimated cost, $150,000.

Ont., Petrolea—The Adams Wagon Co. will build a 1 story, 70 x 200 ft. forge shop. Estimated cost, $25,000.

Ont., Petrolea—The Orton Motor Co., Ltd., will soon award the contract for the construction of a 1 story, 60 x 150 ft. addition to its factory. Estimated cost, $10,000.

Ont., St. Catherine—The Niagara, St. Catherine and Toronto Ry., 27 Wellington St., E., Toronto, is having plans prepared by G. C. Briggs, archt., c/o owner, for the construction of a 1 story, 60 x 150 ft. car shop here. Estimated cost, $60,000.

Ont., Toronto—The Grinnell Co., Ltd., has awarded the contract for the construction of a 1 story, 100 x 150 ft. foundry. Noted May 27.

Que., Montreal—The Archambault Garage Ltd. will build an addition to its garage. Estimated cost, $10,000.

Que., Montreal—P. A. Elliott, 619 Pontiac St., will soon award the contract for the construction of a 2 story, 25 x 48 ft. garage. Estimated cost, $15,000.

Que., Pointe aux Trembles—La Manufacture de Piano et Phonographe, Limitee, will soon award the contract for the construction of a 3 story addition to its plant. Estimated cost, $20,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Hartford—The Hartford Mattress Co., Kilbourn St., is having plans prepared by R. A. Sellew, Archt., 223 Asylum St., for the construction of a 3 story, 43 x 90 ft. addition to its plant. Estimated cost, $50,000.

Conn., Windsor Locks—C. H. Dexter & Sons, Inc., has awarded the contract for the construction of alterations to its plant for the manufacture of tissue paper. Estimated cost, $20,000.

Mass., Cambridge—The Prest-O-Lite Co., Inc., 30 East 42nd St., New York City, has awarded the contract for the construction of a plant on Erie St., here, to consist of twelve 1 story manufacturing buildings. Estimated cost, $100,000. Noted July 15.

Mass., Cambridge—The Revere Sugar Refinery, 15 Broad St., Boston, has awarded the contract for the construction of a 1 story, 90 x 200 ft. cooperage shop on 9th St. here. Estimated cost, $100,000. Noted July 15.

Mass., East Everett—The Boston Varnish Co., 2d St., has awarded the contract for the construction of a 1 story, 40 x 60 ft. addition to its plant on East Summer St. Estimated cost, $30,000. Noted July 22.

R. I., East Greenwich—The Greenwich Mills, Division St., is preparing plans for the construction of a 4 story, 80 x 90 ft. addition to its textile plant. Estimated cost, $50,000.

R. I., East Providence—The Sayles Finishing Co., Phillipsdale, R. I., has awarded the contract for the construction of a 1 story, 45 x 80 ft. factory on Wilson St., here, for cloth finishing. Estimated cost, $18,000.

R. I., Pawtucket—The J. & P. Coats Co., Inc., 366 Pine St., has awarded the contract for the construction of a 4 story addition to its factory for the manufacture of thread. Estimated cost, $22,000.

R. I., Pawtucket—The Lebanon Mill Co., 10 Front St., has awarded the contract for the construction of a 1 and 2 story, 50 x 90 ft. addition to its factory on Front and Thayer Sts., for the manufacture of knit goods. Estimated cost, $25,000.

R. I., Providence—J. F. Concannon, Chalkstone Ave., has awarded the contract for the construction of a 1 story, 75 x 125 ft. laundry on Chalkstone and Fallon Aves. Estimated cost, $28,000.

MIDDLE ATLANTIC STATES

Md., Baltimore—E. H. Koester, 648 West Lexington St., has awarded the contract for the construction of a 4 story, 20 x 80 ft. addition to his bakery on Lexington and Pine Sts. Estimated cost, $150,000.

Md., Baltimore—The Natl. Bitulithic Enamel and Paint Co., Lawrence and Woodall Sts., will soon award the contract for the construction of a 3 story, 100 x 150 ft. addition to its plant. Estimated cost, $100,000. J. R. Broderick, mgr.

Md., Violetville (Baltimore P. O.)—The Presto-Lite Co., Inc., 30 East 42nd St., New York City, has awarded the contract for the construction of a 1 and 2 story acetylene plant here, to consist of 8 buildings. Estimated cost, $125,000.

N. J., Paulsboro—The I. P. Thompson & Son Co. has awarded the contract for the construction of a 1 story, 80 x 220 ft. fertilizer building at its plant.

N. J., Trenton—The Acme Rubber Mfg. Co., East State St., has awarded the contract for the construction of a 1 story, 90 x 300 ft. rubber plant. Estimated cost, $60,000.

Pa., Philadelphia—The G. H. P. Cigar Co., 21 North 2d St., has awarded the contract for the construction of a 6 story, 85 x 100 ft. factory for the manufacture of cigars.

Pa., Philadelphia—The Flint Dental Mfg. Co., Hedge and Gillinham Sts., has awarded the contract for the construction of a 2 story, 30 x 58 ft. addition to its factory for the manufacture of dental supplies.

SOUTHERN STATES

La., New Orleans—The Union Paper Products Co., 109 Tchoupitoulas St., is having preliminary plans prepared by E. Weil, Archt., Whitney Central Bank Bldg., for the construction of a 1 story factory on Colapessa St., to have 50,000 sq.ft. of floor space. Estimated cost, $125,000.

N. C., Charlotte—The Southern Asbestos Mfg. Co. is building a 90 x 304 ft. factory.

Tenn., Knoxville—The Holsten Mfg. Co. has awarded the contract for the construction of an addition to its plant for the manufacture of hosiery. Estimated cost, $250,000.

Va., Richmond—The Standard Paper Co., Hull and Canal Sts., has had preliminary plans prepared by J. H. Wallace & Co., Engrs., 5 Beekman St., New York City, for the construction of a 2, 3 and 4 story, 150 x 230 ft. factory. Estimated cost, $200,000.

MIDDLE WEST

Ill., Chicago—The Enterprise Paint Mfg. Co., 854 West Van Buren St., has awarded the contract for the construction of a 5 story, 44 x 60 ft. addition to its factory on Van Buren and Peoria Sts. Estimated cost, $50,000.

Ind., Gary—The Universal Brick and Tile Co. is building a 1 story, 100 x 200 ft. plant. Estimated cost, $200,000.

Mich., Detroit—The Detroit Packing Co., 40 Bushey St., plans to convert a brewery into a packing plant. Packers Architectural & Eng. Co., 431 South Dearborn St., Chicago, Archts and Engrs.

Mich., Traverse City—The Traverse City Cigar Box Co., Boardman Ave. and East High St., is preparing plans for the construction of a 2 story, 50 x 75 ft. factory. Estimated cost, $20,000.

O., Cleveland—The Baum Ice Cream Co., 1720 Crawford Rd., plans to build a 2 story, 53 x 80 ft. addition to its factory on East 14th St. and Central Viaduct. Estimated cost, $40,000. L. Baum, Pres.

Wis., Milwaukee—The Pitcarn Varnish Co., 213 Lake St., has awarded the contract for the construction of a 2 story, 70 x 106 ft. factory and 60 x 112 ft. warehouse. Estimated cost, $180,000.

Wis., Stephens Point—The Pfiffner Lumber Co. is having plans prepared for the construction of a 2 story, 60 x 100 ft. planing mill, storage and office building. F. Spalenka, Archt.

WEST OF THE MISSISSIPPI

Ia., Des Moines—The Hawkeye Tire Co., 215 East 3rd St., has awarded the contract for the construction of a 4 story, 180 x 280 ft. factory on East 18th and Court Aves. Estimated cost, $500,000.

Minn., Minneapolis—Downs & Eads, 803 Phoenix Bldg., plans to build a 3 to 5 story factory on Malcom Ave. and University Ave. S., for the manufacture of patent medicines. Cost between $125,000 and $150,000.

Minn., St. Paul—The House of the Good Shepherd, Blair and Virginia Sts., has awarded the contract for the construction of a 3 story, 42 x 122 ft. laundry and domestic science building on Blair and Victoria Sts. Estimated cost, $100,000.

Mo., Chillicothe—The Chillicothe Furniture Co. plans to build a 100 x 239 ft. factory. Estimated cost, $80,000. T. A. Ritter, mgr.

Neb., Omaha—The Corn Products Co. plans to build a large plant here.

WESTERN STATES

Ore., Klamath Falls—The Klamath Pine Mfg. Co. is building a sawmill, to have 50,000 sq.ft. floor space. Estimated cost, $100,000. E. W. Doe, gen. mgr.

CANADA

Ont., Alviston—McEachern & Son are preparing plans for the construction of planing mills to replace those which were destroyed by fire.

Ont., Exeter—The Exeter Creamery Co. plans to build an addition to its plant.

Ont., Listowel—The Perfect Knit Mills will build a 3 story, 80 x 280 ft. extension to its plant. Estimated cost, $85,000.

SEE SEARCHLIGHT SECTION
Pages 378-411